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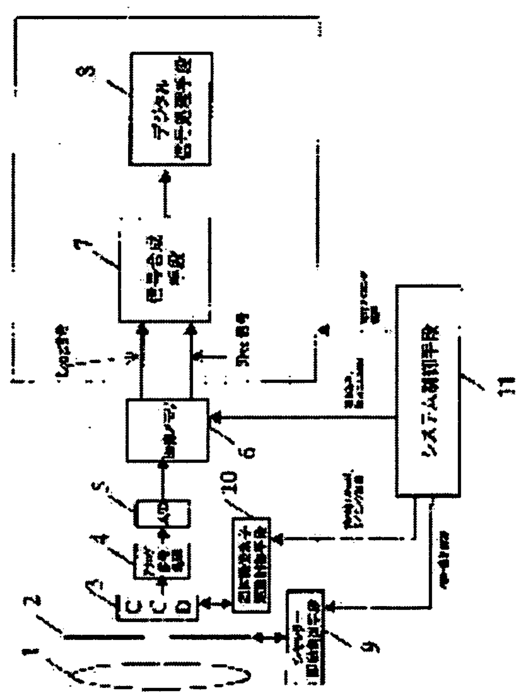
(54) SOLID-STATE IMAGE PICKUP DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To solve such a problem of a conventional dynamic range extension camera that the camera is too expensive because the camera requires a plurality of image pickup element and a full pixel read CCD.

SOLUTION: The solid-state image pickup device of this invention employs an inter-line CCD 3 (IT-CCD) that can read signals in two read modes of a filed read mode and a frame read mode. A system control means 11 controls the exposure of the CCD 3 and the signal read mode to acquire an image by the filed read mode for a short time exposure signal (short signal) and to acquire another image by the frame read mode for a long time exposure signal (long signal). The dynamic range is extended by synthesizing the images by a signal synthesis means 7.



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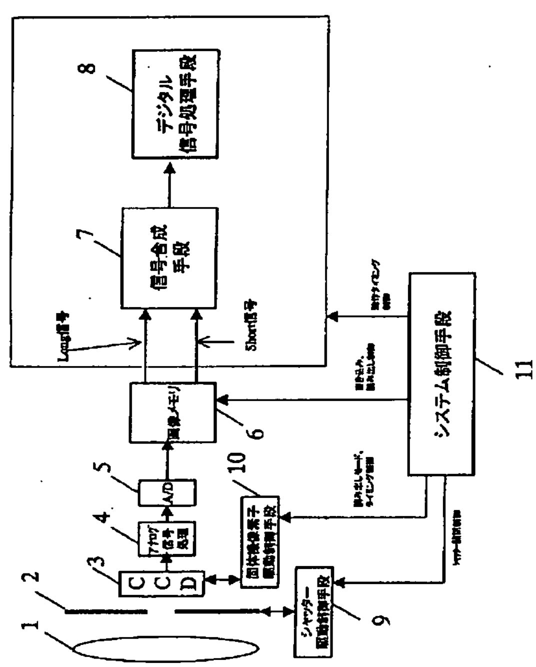
(54)【発明の名称】　固体撮像装置

(57)【要約】
【課題】　従来のダイナミックレンジ拡大カメラでは複数枚の撮像素子や全画素読み出しＣＣＤを必要とし、装置が高価になってしまうという問題があった。
【解決手段】　フィールド読み出しモードとフレーム読み出しモードの２つの読み出しモードで信号を読み出すことが可能なインタラインＣＣＤ３（ＩＴ－ＣＣＤ）を用い、ＣＣＤ３の露光及び信号読み出しモードをシステム制御手段１１にて制御し、短時間露光信号（Ｓｈｏｒｔ信号）はフィールド読み出し、長時間露光信号（Ｌｏｎｇ信号）はフレーム読み出しにより画像を取得し、これら２つの画像を信号合成手段７で合成することによりダイナミックレンジを拡大する。



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【特許請求の範囲】

【請求項１】露光量の異なる複数の画像信号を出力する固体撮像素子と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子から出力される画像信号のうち少なくとも１つは、他の画像信号に比べ画素数の少ない画像信号であることを特徴とする固体撮像装置。

【請求項２】画素数の少ない画像信号とは、垂直方向に画素を間引かれた画像信号であることを特徴とする請求項１記載の固体撮像装置。

【請求項３】行列状に配置された複数個のホトダイオードと、前記ホトダイオード上に蓄積された電荷を外部に出力するための転送手段を有する固体撮像素子と、前記ホトダイオードに入射する光を遮光する遮光手段と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子は、第１露光として前記ホトダイオード上に蓄積された電荷を第１の読み出し制御パルスの印加後に前記転送手段を介して出力し、更に、前記第１の読み出し制御パルス印加後、前記遮光手段による露光終了をもって完了する第２露光において前記ホトダイオード上に蓄積された電荷を第２の読み出し制御パルスの印加後に前記転送手段を介して出力し、前記画像信号合成手段は、前記第１露光及び前記第２露光により撮影された画像信号を合成することを特徴とする固体撮像装置。

【請求項４】行列状に配置された複数個のホトダイオードと、前記ホトダイオード上に蓄積された電荷を外部に出力するための転送手段を有する固体撮像素子と、前記ホトダイオードに入射する光を遮光する遮光手段と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子は、第１露光として前記ホトダイオード上に蓄積された電荷の一部のみを第１の読み出し制御パルスの印加後に前記転送手段を介して出力し、更に、前記第１の読み出し制御パルス印加後、前記遮光手段による露光終了をもって完了する第２露光において前記ホトダイオード上に蓄積された電荷を第２の読み出し制御パルスの印加後に前記転送手段を介して出力し、前記画像信号合成手段は、前記第１露光及び前記第２露光により撮影された画像信号を合成することを特徴とする固体撮像装置。

【請求項５】行列状に配置された複数個のホトダイオードと、前記ホトダイオード上に蓄積された電荷を外部に出力するための転送手段を有する固体撮像素子と、前記ホトダイオードに入射する光を遮光する遮光手段と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子は、第１露光として前記ホトダイオード上に蓄積された電荷を第１の読み出し制御パルスの印加後にフィールド読み出しにより前記転送手段を介して出力し、更に、前記第１の読み出し制御パルス印加後、前記遮光手段による露光終了をもって完了する第２露光において前記ホトダイオード上に蓄積された電荷を第２の読み出し制御パルスの印加後に前記転送手段を介して出力し、前記画像信号合成手段は、前記第１露光及び前記第２露光により撮影された画像信号を合成することを特徴とする固体撮像装置。

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【請求項６】第１露光の露光時間は電子シャッターにより制御することを特徴とする請求項３から請求項５のいずれかに記載の固体撮像装置。

【請求項７】第２の読み出し制御パルスの印加後、第２露光においてホトダイオードに蓄積された電荷はフレーム読み出しにより出力されることを特徴とする請求項３から請求項６のいずれかに記載の固体撮像装置。

【請求項８】第１の読み出し制御パルスの印加後に読み出される画像は、第２の読み出し制御パルス印加後に読み出される画像に比べ、画素数の少ない画像であることを特徴とする請求項３から請求項７のいずれかに記載の固体撮像装置。

【請求項９】機械的な遮光手段は光学絞りを兼用することを特徴とする請求項３から請求項８のいずれかに記載の固体撮像装置。

【請求項１０】露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、画素数の少ない画像信号を、補間処理により画素数の多い画像信号と同じ信号形式に変換する補間手段と、前記画素数の少ない画像信号、もしくは前記補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号、もしくは前記画素数の多い画像信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と前記画素数の多い画像信号とを合成する信号合成手段と、を有することを特徴とする固体撮像装置。

【請求項１１】露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、画素数の少ない画像信号もしくは前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素の少ない画像信号を、補間処理により画素数の多い画像信号と同じ信号形式に変換する補間手段と、前記画素数の少ない画像信号から抽出した輝度信号もしくは前記画素数の多い画像信号から抽出した輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と前記画素数の多い画像信号とを合成する信号合成手段と、を有することを特徴とする固体撮像装置。

【請求項１２】信号合成手段は、合成制御信号の信号レベルに応じてある係数ｋを発生する係数発生手段と、前記係数発生手段により発生された係数ｋに応じて、補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と画素数の多い画像信号を重み付け加算

する合成手段と、を有することを特徴とする請求項１０または請求項１１に記載の固体撮像装置。

【請求項１３】露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、画素数の少ない画像信号と前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素数の少ない画像信号から抽出された輝度信号を、補間処理により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換する第１の補間手段と、前記画素が少ない画像信号から抽出された輝度信号、もしくは前記第１の補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号、もしくは前記画素数の多い画像信号から抽出された輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記第１の補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と前記画素数の多い画像信号から抽出された輝度信号とを合成する輝度信号合成手段と、前記画素数の少ない画像信号を、補間処理により画素数が多い画像信号と同じ信号形式に変換する第２の補間手段と、前記第２の補間手段により画素数が多い画像信号と同じ信号形式に変換された画像信号と前記画素数の多い画像信号を、前記合成制御信号に応じて合成する信号合成手段と、を有することを特徴とする固体撮像装置。

【請求項１４】輝度信号合成手段は、合成制御信号の信号レベルに応じてある係数ｋを発生する第１の係数発生手段と、前記第１の係数発生手段により発生された係数ｋに応じて、第１の補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と画素の多い画像信号から抽出された輝度信号を重み付け加算する第１の合成手段と、を有することを特徴とする請求項１３に記載の固体撮像装置。

【請求項１５】信号合成手段は、第１の係数発生手段により発生された係数ｋのうち少なくとも１つの係数ｋに応じて、第２の補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と画素数の多い画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項１３または請求項１４に記載の固体撮像装置。

【請求項１６】信号合成手段は、第１の係数発生手段により発生された係数ｋのうち、複数個の係数ｋの平均値、最大値、最小値、中間値の少なくともいずれか１つに応じて、第２の補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と画素数の多い画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項１３または請求項１４に記載の固体撮像装置。

【請求項１７】信号合成手段は、合成制御信号の信号レベルに応じてある係数ｋを発生する第２の係数発生手段と、前記第２の係数発生手段により発生された係数ｋに応じて、第２の補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と画素数の多い画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項１３または請求項１４に記載の固体撮像装置。

【請求項１８】露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、前記画素の少ない画像信号と前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素数の少ない画像信号から抽出された輝度信号を、補間処理により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換する補間手段と、前記画素の少ない画像信号から抽出された輝度信号、もしくは前記補間手段により画素の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号、もしくは前記画素数の多い画像信号から抽出された輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と前記画素数の多い画像信号から抽出された輝度信号とを合成する輝度信号合成手段と、前記画素数の多い画像信号を、間引き処理により画素の少ない画像信号と同じ信号形式に変換する間引き手段と、前記間引き手段により画素の少ない画像信号と同じ信号形式に変換された画像信号と前記画素の少ない画像信号を、前記合成制御信号に応じて合成する信号合成手段と、を有することを特徴とする固体撮像装置。

【請求項１９】輝度信号合成手段は、合成制御信号の信号レベルに応じてある係数ｋを発生する第１の係数発生手段と、前記第１の係数発生手段により発生された係数ｋに応じて、補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と画素数の多い画像信号から抽出された輝度信号を重み付け加算する第１の合成手段と、を有することを特徴とする請求項１８に記載の固体撮像装置。

【請求項２０】信号合成手段は、第１の係数発生手段により発生された係数ｋのうち少なくとも１つの係数ｋに応じて、間引き手段により画素数の少ない画像信号と同じ信号形式に変換された画像信号と画素数の少ない画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項１８または請求項１９に記載の固体撮像装置。

【請求項２１】信号合成手段は、第１の係数発生手段により発生された係数ｋのうち、複数個の係数ｋの平均値、最大値、最小値、中間値の少なくともいずれか１つに応じて、間引き手段により画素数の少ない画像信号と同じ信号形式に変換された画像信号と画素数の少ない画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項１８または請求項１９に記載の固体

撮像装置。

【請求項２２】信号合成手段は、合成制御信号の信号レベルに応じてある係数ｋを発生する第２の係数発生手段と、前記第２の係数発生手段により発生された係数ｋに応じて、間引き手段により画素数の少ない画像信号と同じ信号形式に変換された画像信号と画素数の少ない画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項１８または請求項１９に記載の固体撮像装置。

【請求項２３】露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、前記画素の少ない画像信号と前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素数の少ない画像信号から抽出された輝度信号を、補間処理により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換する補間手段と、前記画素の少ない画像信号から抽出された輝度信号、もしくは前記補間手段により画素の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号、もしくは前記画素数の多い画像信号から抽出された輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と前記画素数の多い画像信号から抽出された輝度信号とを合成する輝度信号合成手段と、前記画素数の多い画像信号に対し間引き処理により画素を間引く第１の間引き手段と、前記画素数の少ない画像信号に対し間引き処理により画素を間引く第２の間引き手段と、前記第１の間引き手段及び第２の間引き手段により画素を間引かれた画像信号を、前記合成制御信号に応じて合成する信号合成手段と、を有することを特徴とする固体撮像装置。

【請求項２４】輝度信号合成手段は、合成制御信号の信号レベルに応じてある係数ｋを発生する第１の係数発生手段と、前記第１の係数発生手段により発生された係数ｋに応じて、補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と画素数の多い画像信号から抽出された輝度信号を重み付け加算する第１の合成手段と、を有することを特徴とする請求項２３記載の固体撮像装置。

【請求項２５】　信号合成手段は、第１の係数発生手段により発生された係数ｋのうち少なくとも１つの係数ｋに応じて、第１の間引き手段及び第２の間引き手段により画素を間引かれた画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項２３または請求項２４に記載の固体撮像装置。

【請求項２６】信号合成手段は、第１の係数発生手段により発生された係数ｋのうち、複数個の係数ｋの平均値、最大値、最小値、中間値の少なくともいずれか１つに応じて、第１の間引き手段及び第２の間引き手段により画素を間引かれた画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項２３または請求項２４に記載の固体撮像装置。

【請求項２７】信号合成手段は、合成制御信号の信号レベルに応じてある係数ｋを発生する第２の係数発生手段と、前記第２の係数発生手段により発生された係数ｋに応じて、第１の間引き手段及び第２の間引き手段により画素を間引かれた画像信号を重み付け加算する第２の合成手段を有することを特徴とする請求項２３または請求項２４に記載の固体撮像装置。

【請求項２８】画素数の少ない画像信号とは１フィールドの画像信号であり、画素数の多い画像信号とは１フレームの画像信号であることを特徴とする請求項１、２、３、５、１０、１１、１３、１８、２３のいずれかに記載の固体撮像装置。

【請求項２９】係数発生手段及び第１の係数発生手段及び第２の係数発生手段は、合成制御信号の少なくとも１画素の信号レベルに応じて係数ｋを発生することを特徴とする請求項１０から請求項２７のいずれかに記載の固体撮像装置。

【請求項３０】係数発生手段及び第１の係数発生手段及び第２の係数発生手段は、合成制御信号の複数画素の信号レベルの平均値、最大値、最小値、中間値の少なくともいずれか1つに応じて係数ｋを発生することを特徴とする請求項１０から請求項２７のいずれかに記載の固体撮像装置。

【請求項３１】係数発生手段及び第１の係数発生手段及び第２の係数発生手段は、合成制御信号の１画素毎に対応する係数ｋを発生することを特徴とする請求項１０から請求項２７のいずれかに記載の固体撮像装置。

【請求項３２】係数発生手段及び第１の係数発生手段及び第２の係数発生手段は、合成制御信号の複数画素からなるブロックに対応する係数ｋを発生することを特徴とする請求項１０から請求項２７のいずれかに記載の固体撮像装置。

【請求項３３】係数発生手段及び第１の係数発生手段及び第２の係数発生手段は、合成制御信号の複数画素からなるブロック内の各信号レベルの平均値、最大値、最小値、中間値の少なくともいずれか１つに応じてある係数ｋを発生することを特徴とする請求項１０から請求項２７のいずれかに記載の固体撮像装置。

【請求項３４】係数発生手段及び第１の係数発生手段及び第２の係数発生手段は、合成制御信号の複数画素からなるブロック内の各信号レベルのうち、ブロック内の特定位置に存在する画素の信号レベルに応じてある係数ｋを発生することを特徴とする請求項１０から請求項２７のいずれかに記載の固体撮像装置。

【請求項３５】露光量と画素数の異なる２つの画像信号のうち、画素数の少ない画像信号は短時間露光信号であり、画素数の多い画像信号は長時間露光信号であること

を特徴とする請求項１から請求項３４のいずれかに記載の固体撮像装置。

【請求項３６】露光量と画素数の異なる２つの画像信号のうち、画素数の少ない画像信号は長時間露光信号であり、画素数の多い画像信号は短時間露光信号であることを特徴とする請求項１から請求項３４のいずれかに記載の固体撮像装置。

【請求項３７】固体撮像素子で撮像する画像信号の露光量は、機械的な遮光手段もしくは固体撮像素子の電子シャッター機能により制御することを特徴とする請求項１から請求項３６のいずれかに記載の固体撮像装置。

【請求項３８】固体撮像素子上に形成されるカラーフィルターはマゼンタ、グリーン、イエロー、シアンの４色であることを特徴とする請求項１から請求項３７のいずれかに記載の固体撮像装置。

【請求項３９】固体撮像素子上に形成されるカラーフィルター配列はマゼンタ、グリーン、イエロー、シアンの４色からなる補色市松タイプであることを特徴とする請求項１から請求項３８のいずれかに記載の固体撮像装置。

【請求項４０】固体撮像素子上に形成されるカラーフィルターはレッド、グリーン、ブルーの３色であることを特徴とする請求項１から請求項３７のいずれかに記載の固体撮像装置。

【請求項４１】固体撮像素子上に形成されるカラーフィルター配列はレッド、グリーン、ブルーの３色からなる３色ストライプタイプであることを特徴とする請求項１から請求項３７のいずれかに記載の固体撮像装置。

【請求項４２】固体撮像素子はインタライン転送ＣＣＤ（ＩＴ－ＣＣＤ）であることを特徴とする請求項１から請求項４１のいずれかに記載の固体撮像装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、撮影画像のダイナミックレンジ拡大が可能な固体撮像装置に関するものである。

【０００２】

【従来の技術】従来から、露光量の異なる２つの画像信号を合成してダイナミックレンジの広い映像信号を得るための固体撮像装置としては、例えば、特開平９－２１４８２９号公報及び特開平９－２７５５２７号公報で開示されているものがある。

【０００３】特開平９－２１４８２９号公報においては、露光時間を変えて撮影した連続する２枚のフィールド画像をそれぞれレベルシフトさせた後、１フレームの画像に合成することでダイナミックレンジの広い画像を得ることが可能なデジタルスチルカメラが開示されている。

【０００４】また、特開平９－２７５５２７号公報においては、複数のＣＣＤから得られる露光時間の異なった複数のフレーム画像をそれぞれレベルシフトさせた後、１フレームの画像に合成することでダイナミックレンジの広い画像を得ることが可能なデジタルスチルカメラが開示されている。

【０００５】他にも、１フィールド期間内に長時間露光信号と短時間露光信号を読み出し可能な特殊なＣＣＤを用いてダイナミックレンジを拡大したビデオカメラの例が知られている（映像メディア学会技術報告Vol.22,No.3,pp1～6（1998）”単板Hyper-Dカラーカメラ信号処理方式の開発”）。

【０００６】

【発明が解決しようとする課題】しかしながら、例えば特開平９－２１４８２９号公報にて開示されているデジタルスチルカメラにおいては、露光時間を変えて撮影した連続する２枚のフィールド画像を合成するため、合成後の画像は１フィールド分の画像解像度、つまりＣＣＤの画素数の半分の解像度しか得られず、撮影画像の解像度不足が懸念される。

【０００７】これに対し、特開平９－２７５５２７号公報にて開示されているデジタルスチルカメラにおいては、複数のＣＣＤにより撮影された露光時間の異なる画像信号を合成するために、合成後の画像は１フレーム分の画像解像度、つまりＣＣＤの画素数分の解像度が得られるが、ＣＣＤが複数個必要となり撮像装置のサイズ、コストの面で不利となる。

【０００８】また、映像メディア学会技術報告Vol.22,No.3,pp1～6（1998）”単板Hyper-Dカラーカメラ信号処理方式の開発”で報告済みの撮像装置の場合は撮影画像のダイナミックレンジ拡大には特殊なＣＣＤが必要となる。本発明は以上の問題に鑑みてなされたものであり、民生用固体撮像装置に一般的に用いられる固体撮像素子を１個用いることで安価で、且つＣＣＤの画素数並みの画像解像度でダイナミックレンジを拡大した画像を撮影可能な固体撮像装置を提供することを目的とする。

【０００９】

【課題を解決するための手段】このような課題を解決するために本願の請求項１記載の発明は、露光量の異なる複数の画像信号を出力する固体撮像素子と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子から出力される画像信号のうち少なくとも１つは、他の画像信号に比べ画素数の少ない画像信号であることを特徴とするものである。

【００１０】本願の請求項３記載の発明は、行列状に配置された複数個のホトダイオードと、前記ホトダイオード上に蓄積された電荷を外部に出力するための転送手段を有する固体撮像素子と、前記ホトダイオードに入射する光を遮光する遮光手段と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子は、第１露光として前記ホトダイオード上に蓄積された電荷を第１の読み出し制御パルスの印加

後に前記転送手段を介して出力し、更に、前記第１の読み出し制御パルス印加後、前記遮光手段による露光終了をもって完了する第２露光において前記ホトダイオード上に蓄積された電荷を第２の読み出し制御パルスの印加後に前記転送手段を介して出力し、前記画像信号合成手段は、前記第１露光及び前記第２露光により撮影された画像信号を合成することを特徴とするものである。

【００１１】本願の請求項４記載の発明は、行列状に配置された複数個のホトダイオードと、前記ホトダイオード上に蓄積された電荷を外部に出力するための転送手段を有する固体撮像素子と、前記ホトダイオードに入射する光を遮光する遮光手段と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子は、第１露光として前記ホトダイオード上に蓄積された電荷の一部のみを第１の読み出し制御パルスの印加後に前記転送手段を介して出力し、更に、前記第１の読み出し制御パルス印加後、前記遮光手段による露光終了をもって完了する第２露光において前記ホトダイオード上に蓄積された電荷を第２の読み出し制御パルスの印加後に前記転送手段を介して出力し、前記画像信号合成手段は、前記第１露光及び前記第２露光により撮影された画像信号を合成することを特徴とするものである。

【００１２】本願の請求項５記載の発明は、行列状に配置された複数個のホトダイオードと、前記ホトダイオード上に蓄積された電荷を外部に出力するための転送手段を有する固体撮像素子と、前記ホトダイオードに入射する光を遮光する遮光手段と、前記固体撮像素子から出力される画像信号を合成する信号合成手段と、を有し、前記固体撮像素子は、第１露光として前記ホトダイオード上に蓄積された電荷を第１の読み出し制御パルスの印加後にフィールド読み出しにより前記転送手段を介して出力し、更に、前記第１の読み出し制御パルス印加後、前記遮光手段による露光終了をもって完了する第２露光において前記ホトダイオード上に蓄積された電荷を第２の読み出し制御パルスの印加後に前記転送手段を介して出力し、前記画像信号合成手段は、前記第１露光及び前記第２露光により撮影された画像信号を合成することを特徴とするものである。

【００１３】本願の請求項１０記載の発明は、露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、画素数の少ない画像信号を、補間処理により画素数の多い画像信号と同じ信号形式に変換する補間手段と、前記画素数の少ない画像信号、もしくは前記補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号、もしくは前記画素数の多い画像信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と前記画素数の多い画像信号とを合成する信号合成手段と、を有することを特徴とするものである。

【００１４】本願の請求項１１記載の発明は、露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、画素数の少ない画像信号もしくは前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素の少ない画像信号を、補間処理により画素数の多い画像信号と同じ信号形式に変換する補間手段と、前記画素数の少ない画像信号から抽出した輝度信号もしくは前記画素数の多い画像信号から抽出した輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号と同じ信号形式に変換された画像信号と前記画素数の多い画像信号とを合成する信号合成手段と、を有することを特徴とするものである。

【００１５】本願の請求項１３記載の発明は、露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、画素数の少ない画像信号と前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素数の少ない画像信号から抽出された輝度信号を、補間処理により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換する第１の補間手段と、前記画素が少ない画像信号から抽出された輝度信号、もしくは前記第１の補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号、もしくは前記画素数の多い画像信号から抽出された輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記第１の補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と前記画素数の多い画像信号から抽出された輝度信号とを合成する輝度信号合成手段と、前記画素数の少ない画像信号を、補間処理により画素数が多い画像信号と同じ信号形式に変換する第２の補間手段と、前記第２の補間手段により画素数が多い画像信号と同じ信号形式に変換された画像信号と前記画素数の多い画像信号を、前記合成制御信号に応じて合成する信号合成手段と、を有することを特徴とするものである。

【００１６】本願の請求項１８記載の発明は、露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、前記画素の少ない画像信号と前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素数の少ない画像信号から抽出された輝度信号を、補間処理により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換する補間手段と、前記画素の少ない画像信号から抽出された輝度信号、もしくは前記補間手段により画素の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号、もしくは前記画素数の多

い画像信号から抽出された輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と前記画素数の多い画像信号から抽出された輝度信号とを合成する輝度信号合成手段と、前記画素数の多い画像信号を、間引き処理により画素の少ない画像信号と同じ信号形式に変換する間引き手段と、前記間引き手段により画素の少ない画像信号と同じ信号形式に変換された画像信号と前記画素の少ない画像信号を、前記合成制御信号に応じて合成する信号合成手段と、を有することを特徴とするものである。

【００１７】本願の請求項２３記載の発明は、露光量と画素数の異なる２つの画像信号を出力する固体撮像素子と、前記画素数の異なる２つの画像信号のうち、前記画素の少ない画像信号と前記画素の多い画像信号からその輝度信号を抽出する輝度信号抽出手段と、前記画素数の少ない画像信号から抽出された輝度信号を、補間処理により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換する補間手段と、前記画素の少ない画像信号から抽出された輝度信号、もしくは前記補間手段により画素の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号、もしくは前記画素数の多い画像信号から抽出された輝度信号の少なくとも１つを合成制御信号とし、この合成制御信号に応じて、前記補間手段により画素数の多い画像信号から得られる輝度信号と同じ信号形式に変換された輝度信号と前記画素数の多い画像信号から抽出された輝度信号とを合成する輝度信号合成手段と、前記画素数の多い画像信号に対し間引き処理により画素を間引く第１の間引き手段と、前記画素数の少ない画像信号に対し間引き処理により画素を間引く第２の間引き手段と、前記第１の間引き手段及び第２の間引き手段により画素を間引かれた画像信号を、前記合成制御信号に応じて合成する信号合成手段と、を有することを特徴とするものである。

【００１８】

【発明の実施の形態】（実施の形態１）図１は、本発明の実施の形態１における固体撮像装置のブロック図である。同図において、１は光学レンズ、２は光学絞りと兼用の機械シャッター、３は固体撮像素子であり、本実施の形態１においては民生用固体撮像装置で一般に用いられているインタライン転送ＣＣＤ（ＩＴ－ＣＣＤ）であるとする。４は相関二重サンプリング回路と自動利得制御（ＡＧＣ）回路から構成されるアナログ信号処理手段、５はＡ／Ｄ変換手段、６はＡ／Ｄ変換手段５によりデジタル信号に変換された画像信号を記憶する画像メモリである。７は画像メモリ６から読み出される２系統の画像信号を合成する信号合成手段である。

【００１９】信号合成手段７で得られた信号はデジタル信号処理手段８において、輝度信号と色信号の分離、ノイズ除去、エッジ強調、マトリクス演算、特定のフォーマットへのエンコード等の処理が施される。また機械シャッター駆動制御手段９は機械シャッター２の開閉の制御を行う手段であり、固体撮像素子駆動制御手段１０は固体撮像素子３の露光制御や信号読み出しのモード、タイミング等を制御する手段である。なおこれらを含め上記すべての構成要素の動作モードや動作タイミングはシステム制御手段１１により統合的に制御されるものとする。

【００２０】図２(a)、(b)、(c)、(d)は、固体撮像素子３の動作、構成を説明するための模式図である。なお本発明の実施の形態１において固体撮像素子３は、フィールド読み出しモードとフレーム読み出しモードの２つの読み出しモードで信号を読み出すことが可能なインタライン転送ＣＣＤ（ＩＴ－ＣＣＤ）であり、説明の便宜上、図２のような垂直４画素、水平２画素のいわゆる４×２画素の構成で説明する。

【００２１】図２(a)、(b)は、ＩＴ－ＣＣＤにおけるフィールド読み出しモードを説明するための図である。図２(a)において、ホトダイオードは光電変換により光の強さに応じた信号電荷が蓄積される部分であり、一定時間の後、印加される制御パルスによってこの蓄積された電荷は垂直転送ＣＣＤに移動する。このとき隣接する上下２つのホトダイオードの電荷が垂直転送ＣＣＤ上で混合され、水平転送ＣＣＤを介して外部に出力される。以上が第１フィールドの読み出し動作である。

【００２２】第２フィールドは、図２(b)に示すように、垂直転送ＣＣＤ上で混合されるホトダイオードのペアが第１フィールドの場合比べ垂直方向に１画素ずれる。これにより２フィールド分の信号読み出しにより、インタレース方式の１フレームに相当する画像信号を読み出すことができる。

【００２３】次に、図２(c)、(d)を用いてフレーム読み出しモードについて説明する。フレーム読み出しモードではまず第１フィールドにおいて（図２(c)）、垂直方向に１画素飛ばしでホトダイオードに蓄積された電荷が垂直転送ＣＣＤに転送され、これが水平転送ＣＣＤを介して外部に出力される。そして第２フィールドにおいて（図２(d)）は、第１フィールドで垂直転送ＣＣＤに転送されなかったホトダイオードの電荷が垂直転送ＣＣＤに転送され、これが水平転送ＣＣＤを介して外部に出力される。このようにフレーム読み出しモードではホトダイオード上の電荷が垂直転送ＣＣＤで混合されることなく、外部に出力される。これにより２フィールド分の信号読み出しにより、インタレース方式の１フレームに相当する画像信号を読み出すことができる。

【００２４】図３は、固体撮像素子３上に形成される補色市松タイプのカラーフィルター配列図である。図３中、Ｍｇはマゼンタ、Ｇはグリーン、Ｙｅはイエロー、Ｃｙはシアンの各色を表す。図３に示す通りフォトダイ

オード１画素に対し１色のカラーフィルターが対応している。
【００２５】図４は、信号合成手段７の構成例を示すブロック図である。同図において７０１は画像メモリ６から出力される画像信号の２水平走査ライン分の画像信号を加算する２ライン加算手段である（なお以下、水平走査ラインに相当する画像信号を単に水平ラインもしくは水平ライン信号と称す）。７０２は画像メモリ６から出力される画像信号に対し垂直方向の補間処理を施す補間手段である。重み付け加算手段７０３は２水平ライン加算手段７０１と補間手段７０２の出力を重み付け加算する手段である。
【００２６】図５は、２水平ライン加算手段７０１の構成例を示すブロック図である。同図において７０１０１は１ラインメモリであり画像メモリ６から出力された画像信号の１ライン分を１水平同期期間だけ遅延させる手段である。７０１０２は加算器であり、１ラインメモリ７０１０１において遅延させられた水平ライン信号と、２水平ライン加算手段７０１に入力する水平ライン信号とがこの加算器７０１０２において加算されることで隣接する上下２ラインの加算が行われる。
【００２７】図６は、補間手段７０２の構成を示すブロック図である。同図において７０２０１、７０２０２は１ラインメモリであり画像メモリ６から出力された画像信号の１ライン分を１水平同期期間だけ遅延させる手段である。７０２０３、７０２０４はアンプ手段であり、画像メモリ６からの入力信号及び１ラインメモリ７０２０２の出力信号に対し一定のゲインを乗算する。７０２０５は加算器であり、アンプ手段７０２０３、７０２０４でゲインを乗算された信号を加算する。
【００２８】図７は重み付け加算手段７０３の構成を示すブロック図である。同図において７０３０１は合成係数発生手段であり、ここで２水平ライン加算手段７０１を経た信号の画素毎の信号レベルに応じてある係数ｋ（１≧ｋ≧０）を発生し、ｋ及び１－ｋなる値を乗算器７０３０２、７０３０３に与える。乗算器７０３０２、７０３０３はｋ及び１－ｋを補間手段７０２を経た信号及び２水平ライン加算手段７０１を経た信号に乗算し、この結果は加算器７０３０４にて加算され出力される。
【００２９】以上のように構成された本発明の実施の形態１の固体撮像装置に関し、以下その動作を説明する。本発明の実施の形態１においては、短時間露光信号（以下これをshort信号と称す）と長時間露光信号（以下これをlong信号と称す）の２つの画像を撮影し、これを合成することでダイナミックレンジを拡大した画像を撮影することを特徴とする。このようなダイナミックレンジ拡大の原理を図８を用いて説明する。図８(a)、(b)は露光時の被写体の明るさ（固体撮像素子への入射光量）と固体撮像素子から出力される信号量の関係を示すものである。図８(a)に示すように長時間露光時は入射光により固体撮像素子のホトダイオード上に発生する電荷量が大きく、当然のことながら出力される信号量も大きくなる。しかしホトダイオードに蓄積される電荷量には上限が存在し、この上限を超えると飽和、つまり信号がつぶれてしまう現象が発生し、被写体像を正確に再現することができない。逆に図８(b)に示すように露光時間を短く設定すれば飽和を回避することは可能であるが、今度は被写体内の低輝度部分のＳ／Ｎが劣化する。そこで長時間露光により得られた信号（long信号）と短時間露光で得られた信号（short信号）を用いて、低輝度部はlong信号、高輝度部はshort信号からなる画像を合成すれば、被写体の低輝度部から高輝度部までを再現でき、撮像装置のダイナミックレンジを拡大することが可能となる。この際に、short信号にはlong信号との露光量の比（露光時間の比）に相当するゲインを乗じた後（図８(c)）に合成を行えば図８(d)に示すように露光量の比に応じたダイナミックレンジの拡大が実現できる。例えばlong信号とshort信号の露光量比（露光時間比）が１：Dの場合、ダイナミックレンジはD倍に拡大可能である。以下、上記の原理に従って撮影画像のダイナミックレンジを拡大可能な撮像装置の具体例に関し説明する。まず、short信号とlong信号の撮影方法に関し図９を用いて説明する。図９は固体撮像素子３における被写体像の露光及び露光した信号の読み出しに関するタイミングチャートである。同図において(a)は垂直方向の同期信号、(b)は固体撮像素子３のホトダイオードからの信号電荷読み出しを制御する読み出し制御パルス、(c)は機械シャッター２の開閉状態、(d)は固体撮像素子３のホトダイオード上の露光信号、(e)は固体撮像素子３から出力される信号を示す。short信号の露光時は、機械シャッター２を開放状態にし、電子シャッター機能を用いて必要な露光時間、例えば1／1000秒間露光を行う。1／1000秒の露光が終了した後、読み出し制御パルスによりホトダイオード上の蓄積電荷は垂直転送ＣＣＤに移動させる。このとき固体撮像素子３はフィールド読み出しモードで駆動するものとし、図２(a)で説明したようにホトダイオード上の蓄積電荷を垂直転送ＣＣＤ上で混合し、外部に読み出す。この際読み出す画像信号は第１フィールド分の信号のみとする。図１０にフィールド読み出しモードで読み出されたshort信号を示す。なお固体撮像素子３の垂直方向のホトダイオードの数はN個（説明の便宜上、Nは偶数とするがこれに限るものではない。）とする。図１０に示すように読み出されたshort信号はYe、Cy、G、Mgの４色の信号がそれぞれ加算されたYe+Mg、Cy+G、Ye+G、Cy+Mgの４種類の信号となる。またその垂直方向のライン数はホトダイオードの垂直方向の個数Nの1／2となる。次に、short信号を読み出している間に、long信号の露光を行う。long信号の露光期間は例えば1／100秒とする。long信号の露光時間は機械シャッター２の開閉で制御するものとし、long信号の露光開

始後1／100秒後に機械シャッター２を閉じ露光を完了する。このように機械シャッター２を閉じることで、長時間露光したその信号は読み出し中に余分に露光されることがない。long信号の露光が完了すると読み出し制御パルスによりホトダイオード上の蓄積電荷は垂直転送ＣＣＤに転送される。このとき固体撮像素子３はフレーム読み出しモードで駆動するものとし、図２(c)で説明したように垂直方向の奇数ラインに相当するホトダイオードの電荷を第１フィールド分だけ読み出しを行う。第１フィールドの信号読み出し終了後に、今度は垂直方向の偶数ラインに相当するホトダイオードの電荷を読み出し（第２フィールド）、これによってlong信号は１フレームに相当する信号を固体撮像素子３から読み出す。なお、図９(a)に示した垂直同期信号の周期は例えば1／100秒とし、固体撮像素子３からの１フィールド分の信号読み出しは、垂直同期信号の１周期内で完了するものとする。図１１にフレーム読み出しモードで読み出されたlong信号を示す。図１１に示すように読み出されたlong信号は第１フィールドはYe、Cyの２色の信号となり、第２フィールドはG、Mgの２色の信号となる。またその垂直方向のライン数は各フィールドでホトダイオードの垂直方向の個数Nの1／2であり、２つのフィールドを合わせると１フレームに相当するNラインの信号となる。以上のような露光及び信号読み出しを行うことで、露光時間の異なる２つの信号、つまり１フィールド画像であるshort信号と１フレーム画像であるlong信号を得ることが可能である。なお、short信号は水平ライン数がlong信号の１/2であるため、short信号はlong信号に比べ画素数の少ない信号となっている。次に、固体撮像素子３で得られた露光時間の異なる２つの信号は、アナログ信号処理手段４を経てＡ／D変換手段５によりデジタル信号に変換され画像メモリ６に一旦記憶される。画像メモリ６からはlong信号とshort信号が読み出される。なお、画像メモリ６からlong信号を読み出す際、long信号は第１フィールドの１ライン目、第２フィールドの１ライン目、第１フィールドの２ライン目、というように１フレーム画像としてみた場合の先頭ラインから順に読み出されることとする。画像メモリ６から読み出されたlong信号は２水平ライン加算手段７０１に送られる。２水平ライン加算手段７０１においては、フレーム信号としてみた場合に隣接する上下２ラインのlong信号が加算混合される。これはlong信号とshort信号を合成する際に、２つの信号の信号形式が異なると合成ができないためであり、よってlong信号に対しては２水平ライン加算手段７０１により、固体撮像素子３の垂直転送ＣＣＤ上での画素混合と同一の処理を施し、short信号に対しては補間手段７０２により１フィールド画像を１フレーム画像に変換する。図１２(a)に２水平ライン加算手段７０１において隣接する上下２ラインの信号が加算混合された後のlong信号を、図１２(b)に補間処理前のshort信号を、図１２(c)に補間処理後のshort信号を示す。図１２(a)と(c)に示すように、long信号に対する２水平ライン加算処理及びshort信号に対する補間処理によって、long信号とshort信号の信号形式が合致する。補間手段７０２では、図１２(b)に示すフィールド画像を補間処理により同図(c)に示すフレーム画像に変換するが、その方法について以下に説明する。例えば図１２(b)における第２ラインと第３ラインの間の水平ライン信号を補間処理により求める場合、Ye+G、Cy+Mgの信号からなる水平ライン信号をつくる必要がある。このとき最も近傍のYe+G、Cy+Mgの信号からなるラインは第２ラインと第４ラインであるため、この両者から補間処理により第２ラインと第３ラインの間のラインを求める。但し補間処理により水平ライン信号を求める位置と、第２ライン、第４ラインとの空間的距離は等距離ではないため、その距離に応じて重み付けが必要となる。そこで補間手段７０２においては、連続して入力される３ラインの水平ライン信号のうち中心を除く上下両端のラインが乗算器７０２０３、７０２０４に入力される構成であるため、この乗算器７０２０３、７０２０４で乗じる数をそれぞれ１／４、３／４として重み付けし、その乗算結果を加算器７０２０５にて加算すればよい。なお、乗算器７０２０３、７０２０４にて乗算される数は、補間処理により水平ライン信号を求める位置と、第２ライン、第４ラインとの空間的距離の比が１：３であることから決定する。同様に、第３ラインと第４ラインの間の水平ライン信号を補間処理により求める場合、Ye+Mg、Cy+Gの信号からなる水平ライン信号をつくる必要がり、このとき最も近傍のYe+Mg、Cy+Gの信号からなるラインは第３ラインと第５ラインであるため、この両者との距離の比に応じた重み付けを行い、補間処理により第３ラインと第４ラインの間のラインを求めることができる。

【００３０】以上の処理により、１フレーム分のlong信号と、１フィールド分のshort信号から補間処理を経て得られた１フレームに相当する信号が生成される。

【００３１】これらlong信号とshort信号を合成し、ダイナミックレンジを拡大した信号を合成する手段が、重み付け加算手段７０３である。重み付け加算手段７０３においては図７に示した合成係数発生手段７０３０１によりlong信号の画素毎の信号レベルに応じた合成係数ｋを求め、この合成係数ｋに応じて１画素単位でlong信号と、画面上の同じ空間位置に存在する補間処理により１フレーム画像となったshort信号とを合成する。

【００３２】図１３は合成係数発生手段７０３０１におけるlong信号の信号レベルから画素ごとに合成係数ｋを求める方法の一例である。図１３に示すように、long信号レベルに対し２つの閾値Th#minとTh#maxを設定し、long信号レベルが（数１）の場合、つまりlong信号の信号レベルがTh#min以下で飽和の可能性がない場合は合成係数ｋを０とし、longレベルが（数２）の場合、つまりlo

ng信号レベルがTh#max以上で固体撮像素子の出力が飽和レベルに近いような場合、合成係数ｋを１とする。なお閾値Th#max、Th#minは使用する固体撮像素子の飽和特性やS/Nに応じて適宜決定する。

【００３３】

【数１】

$$0 \leq \text{long 信号レベル} \leq Th\_min$$

【００３４】

【数２】

$$Th\_max \leq \text{long 信号レベル}$$

【００３５】また、long信号レベルが（数３）の場合、つまりlong信号レベルが中間である場合には、図１３に示すように合成係数ｋは（数４）の１次式で決定する。＊

＊【００３６】

【数３】

$$Th\_min < \text{long 信号レベル} < Th\_max$$

【００３７】

【数４】

$$k = \{1 / (Th\_max - Th\_min)\} \times (\text{long 信号レベル}) - \{Th\_min / (Th\_max - Th\_min)\}$$

【００３８】以上のように求められた合成係数ｋを用いて、long信号とshort信号は画素毎に（数５）により合成される。long信号とshort信号を合成した信号を合成信号とする。

【００３９】

【数５】

$$\text{合成信号} = (1 - k) \times \text{long 信号} + k \times \text{short 信号} \times D$$

【００４０】例えば、図１４に示すlong信号(Ye+Mg)L11と、この(Ye+Mg)L11と空間的位置が同じであるshort信号(Ye+Mg)S11から合成信号(Ye+Mg)M11を求める場合、long信号から決定される合成係数をk11とすると（数６）※

※により合成が行われる。

【００４１】

【数６】

$$(Ye+Mg)M11 = (1 - k11) \times (Ye+Mg)L11 + k11 \times (Ye+Mg)S11 \times D$$

【００４２】合成信号の他の画素も（数６）と同様に、同じ空間的位置に存在するlong信号とshort信号から求められる。

【００４３】なお、（数５）及び（数６）においてshort信号に乗算される定数Dは、long信号とshort信号の露光量の比（露光時間の比）であり、例えばlong信号の露光量（露光時間）をTL、short信号の露光量（露光時間）をTSとすると、Dは（数７）で求められる。

【００４４】

【数７】

$$D = TL / TS$$

【００４５】このようにlong信号とshort信号を用いて、long信号の信号レベルが閾値Th#min以下の部分はlong信号、同信号レベルが閾値Th#max以上つまり固体撮像素子３の出力が飽和するに近い部分（撮影画像の輝度が高く、普通ならば信号がつぶれるような部分）はshort信号、その中間の明るさの部分はlong信号とshort信号を重み付け加算した信号からなる合成信号を合成することで、撮影した画像信号のダイナミックレンジを拡大することが可能である。

【００４６】但し、ダイナミックレンジ拡大がなされた合成信号のうち、long信号からなる部分は本来１フレームの画像信号であるため画像解像度が高い。これに対してshort信号からなる部分は１フィールドの画像信号から合成されるため、long信号からなる部分に比べ画像解像度は低い。しかし一般に、画面全体の信号レベルが飽和に近くなるような撮影条件はまれであり、そのような条件下でも、光学絞りを絞りこむなどして入射光量を制限するため画面全体の信号レベルが飽和に近いレベルとなることはなく、撮影画像の大半をshort信号からなる部分が占めることは実使用上あまり起こりえない。また、限られた階調で画像を表現する場合、高輝度部つまり信号レベルが高い部分は低・中輝度部に比べ、少なめに階調が割り当てられることが多い。このためshort信号からなる部分の解像度劣化はさほど目立たず、上記のような方法でlong信号とshort信号を合成してもＣＣＤの画素数並みの解像度の合成画像が得られると考えられる。

【００４７】以上の通り、信号合成手段７において合成された合成信号は、デジタル信号処理手段８において輝度と色信号の分離、ノイズ除去、エッジ強調、ガンマ補正、マトリクス演算、特定のフォーマットへのエンコード等の処理が施される。デジタル信号処理手段８における信号処理に関しては本願発明の目的と直接は関係がないため詳細な説明は省略する。

【００４８】以上のように、本発明の実施の形態１の固体撮像装置においては、固体撮像素子３の露光及び信号読み出しモードを制御し、１フィールド分の短時間露光信号と１フレーム分の長時間露光信号を撮影しこれらを合成することで、ＣＣＤの画素数並みの解像度を持ちながらダイナミックレンジも拡大された画像を撮影することができる。さらに本固体撮像装置で使用する固体撮像素子には、民生用固体撮像装置で一般に用いられているＩＴ－ＣＣＤが使用可能であるため、複数の固体撮像素子や特殊な固体撮像素子を使用する必要がなく、安価に装置を構成することができる。

【００４９】（実施の形態２）本発明の実施の形態２における固体撮像装置は、図１に示した本発明の実施の形態１に対し、重み付け加算手段（本実施の形態２では７０４と付番し区別する）の構成及び同手段でなされる処理が異なる。以下、本発明の実施の形態１と同様の処理内容部分に関しては説明は省略し、本発明の実施の形態

１と異なる部分のみ説明する。

【００５０】図１５は、本発明の実施の形態２における重み付け加算手段７０４のブロック図である。同図において７０４０１は２水平ライン加算手段７０１を経たlong信号から輝度信号成分を抽出する輝度信号抽出手段である。７０４０２は合成係数発生手段であり、ここで輝度信号抽出手段７０４０１を経たlong信号の輝度成分の輝度信号レベルに応じてある係数ｋ（１≧ｋ≧０）を発生し、ｋ及び１－ｋなる値を乗算器７０４０３、７０４０４に与える。乗算器７０４０３、７０４０４はｋ及び１－ｋを補間手段７０２を経たshort信号及び２水平ライン加算手段７０１を経たlong信号に乗算し、この結果は加算器７０４０５にて加算され出力される。

【００５１】図１６は輝度信号抽出手段７０４０１の構成例を示すブロック図である。同図において７０４０１１は入力信号を１画素分の期間だけ遅延させる手段である。７０４０１２は加算器であり、1画素遅延手段７０４０１１において遅延された画素信号と輝度信号抽出手段７０４０１に入力された画素信号を、この加算器７０４０１２において加算することで水平方向に隣接する２画素の加算が行われ信号の低域成分のみを抽出する。輝度信号抽出手段７０４０１により抽出される信号の低域成分はすなわち画像信号の輝度信号に相当する。

【００５２】以上のように構成された本発明の実施の形態２の固体撮像装置に関し、以下その動作を説明する。本発明の実施の形態１と異なり、本発明の実施の形態２においてはlong信号とshort信号を合成する際に使用する合成係数をlong信号から抽出した輝度信号の信号レベルをもとに決定する。そのためlong信号から輝度信号を抽出する手段である輝度信号抽出手段７０４０１を重み付け加算手段７０４内に有する。

【００５３】輝度信号抽出手段７０４０１においては、２水平ライン加算手段７０１の出力のうち水平方向に隣り合う２画素の信号を順次加算することで以下の（数８）に基づきlong信号の輝度成分（以下これをlong輝度信号と称す）を抽出する。　＊

＊【００５４】

【数８】

$$輝度成分（輝度信号）=Ye+Mg+Cy+G$$

【００５５】例えば、図１７に示すlong信号（Ye+Mg）L11とlong信号（Cy+G）L12とからlong輝度信号YL11を求める場合、（Ye+Mg）L11と（Cy+G）L12を加算することになる。同様にlong輝度信号YL12を求める場合は、（Cy+G）L12と（Ye+Mg）L13を加算する。long信号から抽出した輝度信号（long輝度信号）をもとに合成係数を決定する方法を以下に説明する。

【００５６】図１８は合成係数発生手段７０４０２におけるlong輝度信号の信号レベルから画素ごとに合成係数ｋを求める方法の一例である。図１８に示すように、long輝度信号レベルに対し２つの閾値Th#min’とTh#max’を設定し、long輝度信号レベルが（数９）の場合、つまり被写体の輝度レベルがTh#min’以下の低輝度の場合は合成係数ｋを０とし、long輝度信号レベルが（数１０）の場合、つまり被写体の輝度レベルがTh#max’以上の高輝度の場合、合成係数ｋを１とする。なお閾値Th#max’、Th#min’は使用する固体撮像素子の飽和特性やS/Nに応じて適宜決定する。

【００５７】

【数９】

$$0 \leq long輝度信号レベル \leq Th\_min'$$

【００５８】

【数１０】

$$Th\_max' \leq long輝度信号レベル$$

【００５９】また、long輝度信号レベルが（数１１）の場合、つまり輝度が低輝度と高輝度の中間である場合には、図１８に示すように合成係数ｋは（数１２）の１次式で決定する。

【００６０】

【数１１】

$$Th\_min' < long輝度信号レベル < Th\_max'$$

【００６１】

【数１２】

$$k=\{1/(Th\_max'-Th\_min')\}\times(long輝度信号レベル)-\{Th\_min'/(Th\_max'-Th\_min')\}$$

【００６２】以上のように求められた合成係数ｋを用いて、long信号とshort信号は画素毎に（数５）により合成される。long信号とshort信号を合成した信号を合成信号とする。

【００６３】例えば、図１９に示すlong信号(Ye+Mg)L11と、この(Ye+Mg)L11と空間的位置が同じであるshort信　※号(Ye+Mg)S11から合成信号(Ye+Mg)M11を求める場合、これら２つの信号と空間的位置が同じであるlong輝度信号YL11から決定される合成係数（これをky11とする）をもとに（数１３）により合成が行われる。

【００６４】

【数１３】

$$(Ye+Mg)M11=(1-ky11)\times(Ye+Mg)L11+ky11\times(Ye+Mg)S11\times D$$

【００６５】合成信号の他の画素も（数１３）と同様に、同じ空間的位置に存在するlong信号とshort信号から求められる。

【００６６】なお、（数１３）においてshort信号に乗算される定数Dは、本発明の実施の形態１と同様にlong信号とshort信号の露光量の比（露光時間の比）であり、（数７）で求められる。

【００６７】このようにlong信号とshort信号を用いて、低輝度部はlong信号、高輝度部はshort信号、低輝度部と高輝度部の中間の輝度の部分はlong信号とshort

信号を重み付け加算した信号からなる合成信号を合成することで、撮影した画像信号のダイナミックレンジを拡大することが可能である。また、輝度信号はlong信号から抽出される低周波成分といえるため、この輝度信号をもとに合成係数を求める場合、合成係数決定に対しlong信号中のノイズ成分が及ぼす影響を低減することができる。

【００６８】以上のように、本発明の実施の形態２の固体撮像装置においても、固体撮像素子３の露光及び信号読み出しモードを制御し、１フィールド分の短時間露光信号と１フレーム分の長時間露光信号を撮影しこれらを合成することで、ＣＣＤの画素数並みの解像度を持ちつつダイナミックレンジが拡大された画像を撮影することができる。さらに本固体撮像装置で使用する固体撮像素子には、民生用固体撮像装置で一般に用いられているＩＴ－ＣＣＤが使用可能であるため、複数の固体撮像素子や特殊な固体撮像素子を使用する必要がなく、安価に装置を構成することができる。

【００６９】（実施の形態３）図２０は、本発明の実施の形態３における固体撮像装置のブロック図である。同図において、光学レンズ１、光学絞りと兼用の機械シャッター２、固体撮像素子３、アナログ信号処理手段４、Ａ／Ｄ変換手段５、画像メモリ６、シャッター駆動手段９、固体撮像素子駆動手段１０、２水平ライン加算手段７０１、輝度信号抽出手段７０４０１、補間手段７０２の機能、動作は本発明の実施の形態１及び実施の形態２と同様であるため、図１から図１９と同一の番号を付して説明は省略する。

【００７０】図２０に示したブロック図において、上記以外の構成要素に関して説明すると、１２は輝度信号抽出手段７０４０１の出力に対し垂直方向の補間処理を施す輝度信号補間手段であり、輝度信号合成手段１３は輝度信号抽出手段７０４０１と輝度信号補間手段１２の出力を合成する手段である。なお、輝度信号補間手段１２に入力される輝度信号はshort信号から抽出された輝度信号であるためshort輝度信号と称し、long信号から抽出される輝度信号をlong輝度信号と称す。よって輝度信号抽出手段７０４０１から直接、輝度信号合成手段１３に入力される信号がlong輝度信号、輝度信号補間手段１２から輝度信号合成手段１３に入力される信号がshort輝度信号の補間処理後の信号となる。

【００７１】また、信号合成手段１４は２ライン加算手段７０１と補間手段７０２の出力を合成する手段である。１ラインメモリ１５、１６、１７，１８は信号合成手段１４の出力を同時化する際に必要な１水平同期期間分の遅延手段であり、１ラインメモリ１５、１６、１７，１８の出力と信号合成手段１４の出力の合計５ラインの水平ライン信号から同じ空間位置にレッド（R）成分を持つ信号とブルー（B）成分を持つ信号を同時化手段１９で得る。

【００７２】輝度信号合成手段１３で得られた輝度信号と、同時化手段１９で得られたレッド（R）成分を持つ信号とブルー（B）成分を持つ信号はデジタル信号処理手段２０において、ノイズ除去、エッジ強調、マトリクス演算、特定のフォーマットへのエンコード等の処理が施される。なおこれらを含め上記すべての構成要素の動作モードや動作タイミングはシステム制御手段２１により統合的に制御されるものとする。

【００７３】図２１は輝度信号補間手段１２の構成を示すブロック図である。同図において１２０１は１ラインメモリであり輝度信号抽出手段７０４０１から出力された画像信号の１ライン分を１水平同期期間だけ遅延させる手段である。１２０２、１２０３はアンプ手段であり、それぞれ１２０１を経た信号及び輝度信号抽出手段７０４０１を経て輝度信号補間手段１２に入力された信号に対し一定のゲインを乗算する。１２０４は加算器であり、アンプ手段１２０２、１２０３でゲインを乗算された信号を加算する。

【００７４】図２２は輝度信号合成手段１３の構成を示すブロック図である。同図において１３０１は合成係数発生手段であり、ここで輝度信号抽出手段７０４０１を経たlong輝度信号の画素毎の信号レベルに応じてある係数ｋ（１≧ｋ≧０）を発生し、ｋ及び１－ｋなる値を乗算器１３０２、１３０３に与える。乗算器１３０２、１３０３はｋ及び１－ｋをshort輝度信号及びlong輝度信号に乗算し、この結果は加算器１３０４にて加算され出力される。

【００７５】図２３は信号合成手段１４の構成を示すブロック図である。同図において１４０１、１４０２は乗算器であり、輝度信号合成手段１３より供給される係数ｋ及び１－ｋをそれぞれshort信号及び２水平ライン加算後のlong信号に乗算する乗算器である。この乗算結果は加算器１４０３にて加算され出力される。

【００７６】図２４は同時化手段１９の構成を示すブロック図である。同図において１９０１は入力される信号から３つの信号を選択し、出力A、出力B、出力Cに出力するセレクタ、１９０２、１９０３は出力B及び出力Cから出力される信号にある定数を乗算するアンプ手段であり、この乗算後の信号は加算器１９０４にて加算される。１９０５はセレクタ１９０１の出力Aと加算器１９０４の出力を出力D、出力Eに振り分けて出力するセレクタである。なお、セレクタ１９０１、１９０５による信号の出力先の選択は後述の通り、信号の色成分によって振り分けられることとする。

【００７７】以上のように構成された本発明の実施の形態３の固体撮像装置に関し、以下その動作を説明する。本発明の実施の形態３においても、短時間露光信号（short信号）と長時間露光信号（long信号）の２つの画像を撮影し、これを合成することでダイナミックレンジを拡大した画像を撮影する点は本発明の実施の形態１及び

２と同様である。しかし本発明の実施の形態３においては、輝度信号と、後に色信号として処理される信号とで個別に短時間露光信号（short信号）と長時間露光信号（long信号）の合成を行うことを特徴とする。そのために本発明の実施の形態３においては本発明の実施の形態１の場合と同様に、画像メモリ６から読み出されたlong信号は、２水平ライン加算手段７０１においては、フレーム信号としてみた場合に隣接する上下２ラインのlong信号が加算混合される。これはshort信号が固体撮像素子３の垂直転送ＣＣＤ上で画素混合されているため、これにlong信号を合わせるための措置である。

【００７８】輝度信号抽出手段７０４０１においては、本発明の実施の形態２と同様に２水平ライン加算手段７０１の出力のうち水平方向に隣り合う２画素の信号を順次加算することで（数８）に基づきlong信号の輝度成分（以下これをlong輝度信号と称す）を抽出する。

【００７９】例えば、図１７に示すlong信号（Ye+Mg）L11とlong信号（Cy+G）L12とからlong輝度信号YL11を求める場合、（Ye+Mg）L11と（Cy+G）L12を加算することになる。同様にlong輝度信号YL12を求める場合は、（Cy+G）L12と（Ye+Mg）L13を加算する。

【００８０】次に、画像メモリ６から読み出されるshort信号は、まず輝度信号抽出手段７０４０１においてlong信号の場合と同様に輝度信号が求められる。

【００８１】図２５にlong輝度信号、図２６にshort輝度信号を示す。

【００８２】図２６に示すようにshort信号は１フィールドの信号であったため、short輝度信号も当然１フィールドの輝度信号である。そこでこの１フィールドのshort輝度信号を１フレームの信号に変換し、long輝度信号と信号形式を同一とするための手段が、輝度信号補間手段１２である。

【００８３】輝度信号補間手段１２は具体的には、図２＊１に示したアンプ手段１２０２、１２０３で乗算するゲインを０.５とすることで連続する２ラインの加算平均値を求めこれを補間信号とする。図２７に補間処理後のshort輝度信号を示す。

【００８４】以上の処理により、１フレーム分のlong信号から得られた輝度信号（long輝度信号）と、１フィールド分のshort信号から補間処理を経て得られた１フレームに相当する輝度信号（short輝度信号）が生成される。このように１フィールドのshort信号から１フレームのshort輝度信号を合成した理由は、short信号とlong信号を合成してダイナミックレンジ拡大を図る際に、short信号が１フィールドの信号のままでは画像を構成する水平ラインが不足し、１フレームの信号であるlong信号と合成することができないためである。

【００８５】これらlong輝度信号とshort輝度信号を合成し、ダイナミックレンジを拡大した輝度信号を合成する手段が、輝度信号合成手段１３である。輝度信号合成手段１３においては図２２に示した合成係数発生手段１３０１によりlong輝度信号の画素毎の信号レベルに応じた合成係数ｋを求め、この合成係数ｋに応じて１画素単位でlong輝度信号と、画面上の同じ空間位置に存在するshort輝度信号とを合成する。

【００８６】long輝度信号の信号レベルから画素ごとに合成係数ｋを求める方法の一例としては、本発明の実施の形態２と同様の方法が考えられるため説明は省略する。

【００８７】求められた合成係数ｋを用いて、long輝度信号とshort輝度信号は画素毎に（数１４）により合成される。long輝度信号とshort輝度信号を合成した信号を合成輝度信号とする。

【００８８】

【数１４】

$$\text{合成輝度信号} = (1-k) \times \text{long 輝度信号} + k \times \text{short 輝度信号} \times D$$

【００８９】例えば、図２８に示すlong輝度信号YL11と、このYL11と空間的位置が同じであるshort輝度信号YS11から合成輝度信号YM11を求める場合、long輝度信号（YL11）から決定される合成係数をk11とすると（数１５）により合成が行われる。

【００９０】

【数１５】

$$YM11 = (1-k11) \times YL11 + k11 \times YS11 \times D$$

【００９１】合成輝度信号の他の画素も（数１５）と同様に、同じ空間的位置に存在するlong輝度信号とshort輝度信号から求められる。

【００９２】なお、（数１４）及び（数１５）においてshort輝度信号に乗算される定数Dは、long信号とshort信号の露光量の比（露光時間の比）であり（数７）で求められる。

【００９３】このようにlong輝度信号とshort輝度信号を用いて、低輝度部はlong輝度信号、高輝度部はshort輝度信号、低輝度部と高輝度部の中間の輝度の部分はlong輝度信号とshort輝度信号を重み付け加算した信号からなる合成輝度信号を合成することで、撮影した画像の輝度信号のダイナミックレンジを拡大することが可能である。

【００９４】但し、ダイナミックレンジ拡大がなされた輝度信号のうち、long輝度信号からなる部分は本来１フレームの画像信号であるため画像解像度が高い。これに対してshort輝度信号からなる部分は１フィールドの画像信号から合成されるため、long輝度信号からなる部分に比べ画像解像度は低い。しかし一般に、画面全体が高輝度となるような撮影条件下はまれであり、そのような条件下でも、光学絞りを絞りこむなどして入射光量を制限するため画面全体が高輝度となることはなく、撮影画像の大半をshort輝度信号からなる部分が占めることは

実使用上あまり起こりえない。また、限られた階調で画像を表現する場合、高輝度部は低・中輝度部に比べ、少なめに階調が割り当てられることが多い。このためshort輝度信号からなる部分の解像度劣化はさほど目立たず、上記のような方法でlong輝度信号とshort輝度信号を合成してもＣＣＤの画素数並みの解像度の合成画像が得られると考えられる。

【００９５】以上が輝度信号の合成によるダイナミックレンジ拡大に関する処理内容である。次に、色信号に関する処理について説明する。

【００９６】画像メモリ６から読み出されたshort信号と、２水平ライン加算手段７０１において隣接する上下２ラインが加算されたlong信号は、色信号のダイナミックレンジ拡大のための合成処理を信号合成手段１４において施される。

【００９７】なお、short信号は１フィールド信号であるため１フレーム信号であるlong信号と信号形式が異なる。よって本発明の実施の形態１と同様に、補間手段７０２によって１フィールド画像を１フレーム画像に変換する。２水平ライン加算手段７０１において隣接する上下２ラインの信号が加算混合された後のlong信号及び補間手段７０２において補間処理されたshort信号は、図１２(a)、(c)示す通りであり、本発明の実施の形態１と同様にlong信号に対する２水平ライン加算処理及びshort信号に対する補間処理によって、long信号とshort信号の信号形式が合致している。

【００９８】信号合成手段１４におけるlong信号とshort信号の合成は、本発明の実施の形態２と同様に、信号合成手段１４に入力されるlong信号及びshort信号と空間的に位置が一致しているlong輝度信号とshort輝度信号とが合成される際に使用される合成係数ｋ及び（数７）で求められるDにより画素毎に実施される。信号合成手段１４で合成された信号を合成信号と称す。

【００９９】以上が色信号のダイナミックレンジ拡大のための合成処理である。

【０１００】さて、信号合成手段１４で求められた合成信号は、Ye+Mg及びCy+Gの画素が水平方向に並ぶラインと、Ye+G及びCy+Mgの画素が水平方向に並ぶラインが垂直方向に２ライン周期で繰り返される構成のため、色の三原色であるレッド、グリーン、ブルーをそれぞれR、G、Bとすると、Ye+Mg及びCy+Gの画素が並ぶラインからは（数１６）によりR成分を持った２R－Gなる色信号が、Ye+G及びCy+Mgが並ぶラインからは（数１７）によりB成分を持った２B－Gなる色信号が得られる。

【０１０１】

【数１６】

$$(Yc+Mg) - (Cy+G) \fallingdotseq 2R-G$$

【０１０２】

【数１７】

$$(Cy+Mg) - (Yc+G) \fallingdotseq 2B-G$$

【０１０３】これはいわゆる色差線順次であり、１水平ライン信号に対して色信号はR成分を持った２R－G、もしくはB成分を持った２B－Gのどちらか一方しか得られない。そこで１水平ライン信号に対し、R成分とB成分の双方の成分を持った信号を得るために、ラインメモリ１５、１６、１７、１８及び同時化手段１９により同時化処理が施される。

【０１０４】ラインメモリ１５、１６、１７、１８及び同時化手段１９による同時化処理の具体的な内容を以下に説明する。同時化手段１９には信号合成手段１４及びラインメモリ１５、１６、１７、１８から連続する５ラインの水平ライン信号が入力される。信号合成手段１４で合成された信号を合成信号を図２９(a)とし、仮に同時化手段１９に入力される５ラインの信号が図２９(b)に示す第３ライン～第７ラインの信号であったとする。このとき、同時化処理の対象は入力される５ラインの中心に位置する水平ライン信号であるとし、図２９(b)の第５ラインの水平ライン信号に対し同時化処理を行うとすると、第５ラインはR成分を持った２R－Gに対応する信号であるため、B成分を持った２B－Gは周辺の水平ライン信号から補間処理によりつくり出せばよい。そこで図２４に示す同時化手段１９においてはセレクタ１９０１は、第５ラインの信号を出力Aに、第３ライン及び第７ラインの２B－Gに対応する信号を出力B及び出力Cに出力する。アンプ手段１９０２、１９０３で乗算するゲインは0.5とし、この乗算結果を加算器１９０４で加算すれば第３ラインと第７ラインの加算平均結果が求められる。この加算平均結果とセレクタ１９０１の出力Aの出力である第５ラインの信号はセレクタ１９０５に入力され、ここで出力先が選択され、２R－Gに対応する第５ラインの水平ライン信号は出力Dに、２B－Gに対応する第３ラインと第７ラインの加算平均結果は出力Eに出力される。このような動作により第５ラインが存在する空間位置に、R成分を持った２R－Gに対応する信号とB成分を持った２B－Gに対応する信号を得ることができる。同様に、例えば同時化手段１９に第５ライン～第９ラインの信号が入力され、第７ラインの水平ライン信号に対し同時化処理を行うとすると、第７ラインはB成分を持った２B－Gに対応する信号であるため、今度はR成分を持った２R－Gは周辺の水平ライン信号から補間処理によりつくり出せばよい。そこで図２４に示す同時化手段１９においてはセレクタ１９０１は、第７ラインの信号を出力Aに、第５ライン及び第９ラインの２R－Gに対応する信号を出力B及び出力Cに出力する。アンプ手段１９０２、１９０３で乗算するゲインは0.5とし、この乗算結果を加算器１９０４で加算すれば第５ラインと第９ラインの加算平均結果が求められる。この加算平均結果とセレクタ１９０１の出力Aの出力である第７ラインの信号はセレクタ１９０５に入力され、ここで出力先が選択され２B－Gに対応する第７ラインの水平ライン信号は出力E

に、２R－Gに対応する第５ラインと第９ラインの加算平均結果は出力Dに出力される。このような動作により第７ラインが存在する空間位置に、R成分を持った２R－Gに対応する信号とB成分を持った２B－Gに対応する信号を得ることができる。なお、同時化手段１９は入力信号に応じて上記のような処理が行われるよう、入出力信号の選択等が自動的もしくはシステム制御手段２１の制御により実施されるものとする。

【０１０５】以上の通り、輝度信号合成手段１３において合成された合成輝度信号及び同時化手段１９で得られたR成分を持った２R－Gに対応する信号とB成分を持った２B－Gに対応する信号は、デジタル信号処理手段２０においてノイズ除去、エッジ強調、ガンマ補正、マトリクス演算、特定のフォーマットへのエンコード等の処理が施される。デジタル信号手段２０における信号処理に関しては本願発明の目的と直接は関係がないため詳細な説明は省略する。

【０１０６】以上のように、本発明の実施の形態３の固体撮像装置においては、固体撮像素子３の露光及び信号読み出しモードを制御し、１フィールド分の短時間露光信号と１フレーム分の長時間露光信号を撮影しこれらを合成することで、固体撮像素子の画素数並みの解像度を持ちながらもダイナミックレンジが拡大された画像を撮影することができる。さらに本固体撮像装置で使用する固体撮像素子には、民生用固体撮像装置で一般に用いられているＩＴ－ＣＣＤが使用可能であるため、複数の固体撮像素子や特殊な固体撮像素子を使用する必要がなく、安価に装置を構成することができる。

【０１０７】（実施の形態４）本発明の実施の形態４における固体撮像装置は、図２０に示した本発明の実施の形態３に対し、２水平ライン加算手段７０４０１の出力に対する間引き手段２２が追加され、これに伴い補間手段７０２、１ラインメモリ１７、１８が削除され、さらに信号合成手段、同時化手段、デジタル信号処理手段、システム制御手段の構成・機能が異なる（本発明の実施の形態４では信号合成手段２３、同時化手段２４、デジタル信号処理手段２５、システム制御手段２６と付番し区別する）点が主な相違点であるため、以下、本発明の実施の形態３と同様の処理内容部分に関しては説明は省略し、本発明の実施の形態３と異なる部分のみ説明する。図３０は、本発明の実施の形態４における固体撮像装置のブロック図である。同図において、間引き手段２２は２水平ライン加算手段７０１の出力からその水平ライン信号を間引き、１フレーム画像を１フィールド画像に変換する手段である。信号合成手段２３は、間引き手段２２及び画像メモリ６の出力を輝度信号合成手段１３にて求められる合成係数ｋに基づき合成する手段である。同時化手段２４は、信号合成手段２３の出力を同時化処理する手段である。

【０１０８】輝度信号合成手段１３で得られた輝度信号と、同時化手段２４で得られたレッド（R）成分を持つ信号とブルー（B）成分を持つ信号はデジタル信号処理手段２５において、ノイズ除去、エッジ強調、マトリクス演算、特定のフォーマットへのエンコード等の処理が施される。なおこれらを含め上記すべての構成要素の動作モードや動作タイミングはシステム制御手段２６により統合的に制御されるものとする。

【０１０９】図３１は同時化手段２４の構成を示すブロック図である。２４０１、２４０２は信号合成手段２３と１ラインメモリ１６を経た信号にある定数を乗算するアンプ手段であり、この乗算後の信号は加算器２４０３にて加算される。２４０４は１ラインメモリ１５の出力と加算器２４０３の出力を出力D、出力Eに振り分けて出力するセレクタである。なお、セレクタ２４０４による信号の出力先の選択は後述の通り、信号の色成分によって振り分けられることとする。以上のように構成された本発明の実施の形態４の固体撮像装置に関し、以下その動作を説明する。

【０１１０】本発明の実施の形態３で説明したように、２水平ライン加算手段７０１の出力は１フレーム画像であるlong信号である。しかし画像メモリ６に記憶されているshort信号は１フィールド画像であるため、このままでは信号合成手段２３においてlong信号とshort信号は合成が行えない。そこで本発明の実施の形態４においてはshort信号を補間処理により１フレームの信号に変換した。

【０１１１】本発明の実施の形態４においては、色信号は輝度信号と同程度の情報量を持たなくても画質面で問題がないことを利用して、本発明の実施の形態３とは逆に、１フレーム画像であるlong信号に対し垂直方向の間引き処理を施すことでlong信号を１フィールド画像に変換し、色信号合成手段２４においてshort信号と合成する。具体的には図１２(a)に示したような２ライン加算後のlong信号の偶数ラインを間引き手段２２により間引くことで、信号合成手段２３に入力されるlong信号を１フィールド画像に変換する。この間引き後のlong信号は図１２(b)に示したようなshort信号と同様の形式となる。

【０１１２】信号合成手段２３においては入力される１フィールド画像であるlong信号とshort信号は、本発明の実施の形態３と同様に、これらの信号と空間的に位置が一致しているlong輝度信号とshort輝度信号とが合成される際に使用される合成係数ｋ及び（数７）で求められるDにより画素ごとに合成される。信号合成手段２３で合成された信号を合成信号と称す。

【０１１３】次に、合成信号は同時化手段２４において同時化処理がなされるが、本発明の実施の形態３と異なり、合成信号は１フィールド信号であるため、同時化手段２４に入力する信号は例えば図３２(b)に示すように第２ラインから第４ラインの３ライン分でよい。この３

ラインの信号から本発明の実施の形態３と同様にR成分を持った２R－Gに対応する信号とB成分を持った２B－Gに対応する信号を得ることができる。例えば、第３ラインの位置にR成分を持った２R－Gに対応する信号とB成分を持った２B－Gに対応する信号を得るには、第２ラインと第４ラインの信号を加算平均して２B－Gに対応する信号を合成すればよい。

【０１１４】同時化手段２４で得られた２つの信号はデジタル信号処理手段２５において本発明の実施の形態３と同様に処理されるが、本発明の実施の形態４では信号合成手段２３で合成された合成信号は１フィールド信号であるため、必要があればデジタル信号処理手段２５においてフレーム画像への変換等がなされることは言うまでもない。

【０１１５】以上のように、本発明の実施の形態４の固体撮像装置においても、本発明の実施の形態３と同様に固体撮像素子３の露光及び信号読み出しモードを制御し、１フィールド分の短時間露光信号と１フレーム分の長時間露光信号を撮影しこれらを合成することで、固体撮像素子の画素数並みの解像度を持ちつつダイナミックレンジが拡大された画像を撮影することができる。さらに本発明の実施の形態４においては、色信号をフィールド信号として処理するため、１ラインメモリの必要個数等を削減でき、より安価に装置を構成することができる。なお本発明の実施の形態１において、short信号はフィールド読み出しモードで読み出した１フィールド画像としたがこれに限るものではなく、例えば垂直方向に水平ライン信号を間引いて読み出す構成も考えられる。一例としては、図３３に示すように固体撮像素子３からshort信号を読み出す場合に垂直方向に３ライン毎に１ラインの信号を読み出す構成が考えられる。この場合、short信号は固体撮像素子上で上下２つのホトダイオードに蓄積された電荷が混合されずに読み出されるため、long信号に対する２水平ライン加算処理が不要となる。また、図４に示した補間手段７０２による補間処理においては、short信号の水平ライン数をlong信号に合わせるように補間処理を行う必要がある。つまり補間手段７０２においてはshort信号の各水平ライン信号間に２ライン分の水平ライン信号を補間処理により作成することになる。これによりshort信号とlong信号は同一の信号形式となり図４に示した重み付け加算手段７０３により合成することが可能となる。この場合、合成係数ｋは上下２水平ライン加算されていないlong信号の各画素の信号レベルから例えば図１３に示したような方法で求めればよい。なお、このようにshort信号を間引いて読み出す場合はlong信号に対する２水平ライン加算処理が不要と記したがこれに限るものではなく、long信号、short信号ともに２水平ライン加算処理を施した後に、合成処理を行う構成も考えられる。

【０１１６】また、本発明の実施の形態１において、露光量の異なる２つの信号は１フィールド画像であるshort信号と１フレーム画像であるlong信号としたがこれに限るものではなく、固体撮像装置の用途によっては１フィールド画像であるlong信号と１フレーム画像であるshort信号としてもよい。この場合、図３４に示すようにlong信号に対し補間手段７０２により垂直方向の補間処理を行い、short信号に対しては２水平ライン加算手段７０１により隣接する上下２ラインの加算を行う構成とすればよく、重み付け加算手段７０３で使用する合成係数は補間処理後のlong信号から求めればよい。また、補間処理前のlong信号から合成係数を求める構成も考えられ、この場合、図3.4 (a)に示したshort信号の偶数ラインの位置には対応するlong信号が存在せず合成係数ｋを決めることができないため、short信号の偶数ラインの上下のラインと同じ位置に存在するlong信号の水平ライン信号から求められる合成係数から、short信号の偶数ラインの位置の合成係数を決定するなどをすればよい。このように、１フィールド画像であるlong信号と１フレーム画像であるshort信号から合成信号を求めることで、高輝度部での解像度の高いダイナミックレンジ拡大画像が撮影可能である。

【０１１７】また、本発明の実施の形態１及び本発明の実施の形態２において、補間手段７０２は１ラインメモリを２個使用し、２水平ライン分の信号から補間処理を行う構成としたがこれに限るものではなく、例えば更に多数の１ラインメモリを用いて、更に多数の水平ライン信号から高次の内挿処理により補間処理を行う構成も考えられる。また、図３５に示すように入力される１水平ラインを２回ずつ繰り返し出力することで水平ライン数を２倍にするいわゆる前値補間を行う構成も考えられる。

【０１１８】また、本発明の実施の形態１において、信号合成手段７では、long信号とshort信号を合成するための合成係数ｋはlong信号の画素毎に求めるものとしたがこれに限るものではなく、例えば複数の画素の信号レベルの平均値もしくは最小値もしくは最大値もしくは中間値から画素毎の合成係数ｋを求める構成や、画素毎に求められたｋの値のうち複数個から求めたｋの平均値もしくは最小値もしくは最大値もしくは中間値を画素毎の合成係数とする構成も考えられる。

【０１１９】また、本発明の実施の形態１において、信号合成手段７では、複数の画素からなるブロックに対して合成係数を求めて合成を行う構成も考えられる。例えば図３６において、long信号(Ye+Mg)L11と(Cy+G)L12、(Ye+Mg)L13と(Cy+G)L14をそれぞれ１ブロックとし、これと同位置に存在するshort信号(Ye+Mg)S11と(Cy+G)S12、(Ye+Mg)S13と(Cy+G)S14をそれぞれ１ブロックとすると、この２画素単位のブロック毎に合成係数を求め、合成を行うことも可能であり、このとき例えばlong信号(Ye+Mg)L11と(Cy+G)L12からなるブロックとshort信号(Ye+

Mg)S11と(Cy+G)S12の合成は、このブロックの合成係数をkb11とするとそれぞれ（数１８）のように行う。((Ye+Mg)M11、(Cy+G)M12は合成後の信号）

【０１２０】

【数１８】

$$(Ye+Mg)M11=(1-kb11)\times(Ye+Mg)L11+kb11\times(Ye+Mg)S11\times D$$
$$(Cy+G)M12=(1-kb11)\times(Cy+G)L12+kb11\times(Cy+G)S12\times D$$

【０１２１】この場合、合成係数kb11はブロックに含まれるlong信号（例えば(Ye+Mg)L11と(Cy+G)L12）のいずれかの信号レベル、もしくはブロックに含まれるlong信号（例えば(Ye+Mg)L11と(Cy+G)L12）の平均値、最大値、最小値、中間値の少なくともいずれかから図１３に示した方法で求まるｋをブロックの合成係数kb11とすればよい。また、ブロックに含まれるlong信号の各信号レベルから図１３に示した方法で求められる画素毎のｋの値（例えば図３６中のｋ１、ｋ２）の平均値、最大値、最小値、中間値のいずれかをブロックの合成係数kb11とする構成も考えられる。なおブロック内の画素数は２画素と限らないことはいうまでもない。

【０１２２】また、本発明の実施の形態１において、信号合成手段７では、複数の画素からなるブロックを設け、このブロック内の特定の位置、例えばブロックの中心位置に存在するlong信号レベルから図１３に示した方法で求まる合成係数をブロック内の各画素の合成処理に用いる構成も考えられる。この場合、合成係数を画素毎に求める必要がなく、処理を簡略化できる。なお、合成係数を求める際に使用する画素の位置はブロックの中心位置に限る必要はない。また、本発明の実施の形態１において、信号合成手段７では、合成係数ｋはlong信号ではなくフレーム画像に変換したshort信号から求める構成も考えられる。また、フレーム画像に変換したshort信号ではなく、フィールド画像であるshort信号から合成係数ｋを求める構成も考えられる。この場合、図１２からわかるようにlong信号の偶数ラインに対応するshort信号は存在しないため、このままでは合成係数を決定することができない。この場合、long信号の偶数ラインに対応する位置の合成係数は周辺のshort信号もしくは周辺の合成係数から求めればよい。

【０１２３】また、本発明の実施の形態１において信号レベルから合成係数ｋを求める方法の例を図１３に示したが、合成係数ｋの決定方法はこれに限るものではなく、例えば図３７に示すように輝度レベルに応じて非線形にｋを決定する方法も考えられる。

【０１２４】また、本発明の実施の形態２において、short信号はフィールド読み出しモードで読み出した１フィールド画像としたがこれに限るものではなく、一例としては、図３３にあげたように垂直方向に水平ライン信号を間引いて読み出す構成も考えられる。この場合、short信号は固体撮像素子上で上下２つのホトダイオードに蓄積された電荷が混合されずに読み出されるため、long信号に対する２水平ライン加算処理が不要となる。また、図４に示した補間手段７０２による補間処理においては、short信号の水平ライン数をlong信号に合わせるように補間処理を行う必要がある。つまり補間手段７０２においてはshort信号の各水平ライン信号間に２ライン分の水平ライン信号を補間処理により作成することになる。これによりshort信号とlong信号は同一の信号形式となり図４に示した重み付け加算手段７０３により合成することが可能となる。但し、図１５に示した輝度信号抽出手段７０４０１には上下２水平ライン加算されていないlong信号が供給されるため、同手段に輝度信号抽出のための２水平ライン加算処理を新たに追加する必要がある。あるいは輝度信号抽出手段７０４０１の前段に２水平ライン加算手段７０１と同様の手段を設け、輝度信号抽出手段７０４０１には２水平ラインが加算された信号が供給されるようにする必要がある。なお、このようにshort信号を間引いて読み出す場合はlong信号に対する２水平ライン加算処理が不要と記したがこれに限るものではなく、long信号、short信号ともに２水平ライン加算処理を施した後に、合成処理を行う構成も考えられる。

【０１２５】また、本発明の実施の形態２において、露光量の異なる２つの信号は１フィールド画像であるshort信号と１フレーム画像であるlong信号としたがこれに限るものではなく、固体撮像装置の用途によっては１フィールド画像であるlong信号と１フレーム画像であるshort信号としてもよい。この場合、図３４に示すようにlong信号に対し補間手段７０２により垂直方向の補間処理を行い、short信号に対しては２水平ライン加算手段７０１により隣接する上下２ラインの加算を行う構成とすればよく、重み付け加算手段７０３で使用する合成係数は補間処理後のlong信号から抽出された輝度信号から求めればよい。また、補間処理前のlong信号から抽出された輝度信号から合成係数を求める構成も考えられ、この場合、図３４(a)に示したshort信号の偶数ラインの位置には対応するlong信号が存在せず合成係数ｋを決めることができないため、short信号の偶数ラインの上下のラインと同じ位置に存在するlong信号の水平ライン信号から抽出された輝度信号より求められる合成係数から、short信号の偶数ラインの位置の合成係数を決定するなどをすればよい。このように、１フィールド画像であるlong信号と１フレーム画像であるshort信号から合成信号を求めることで、高輝度部での解像度の高いダイナミックレンジ拡大画像が撮影可能である。

【０１２６】また、本発明の実施の形態２において、信号合成手段７では、long信号とshort信号を合成するための合成係数ｋはlong輝度信号の画素毎に求めるものと

したがこれに限るものではなく、例えば複数の画素の輝度信号レベルの平均値もしくは最小値もしくは最大値もしくは中間値から画素毎の合成係数ｋを求める構成や、画素毎に求められたｋの値のうち複数個から求めたｋの平均値もしくは最小値もしくは最大値もしくは中間値を画素毎の合成係数とする構成も考えられる。

【０１２７】また、本発明の実施の形態２において、信号合成手段７では、複数の画素からなるブロックに対して合成係数を求めて合成を行う構成も考えられる。例えば図３８において、long信号(Ye+Mg)L11と(Cy+G)L12、(Ye+Mg)L13と(Cy+G)L14をそれぞれ１ブロックとし、これと同位置に存在するshort信号(Ye+Mg)S11と(Cy+G)S12、(Ye+Mg)S13と(Cy+G)S14をそれぞれ１ブロックとすると、この２画素単位のブロック毎に合成係数を求め、合成を行うことも可能であり、このとき例えばlong信号(Ye+Mg)L11と(Cy+G)L12からなるブロックとshort信号(Ye+Mg)S11と(Cy+G)S12の合成は、このブロックの合成係数をkb11とするとそれぞれ（数１８）のように行う。この場合、合成係数kb11はブロックに対応するlong輝度信号（例えば図３８中のYL11とYL12）のいずれかの信号レベル、もしくはブロックに対応するlong輝度信号の平均値、最大値、最小値、中間値の少なくともいずれかから図１８に示した方法で求まるｋをブロックの合成係数kb11とすればよい。また、ブロックに対応するlong輝度信号の各信号レベルから図１８に示した方法で求められる画素毎のｋの値（例えば図３８中のｋ１、ｋ２）の平均値、最大値、最小値、中間値のいずれかをブロックの合成係数kb11とする構成も考えられる。なおブロック内の画素数は２画素と限らないことはいうまでもない。

【０１２８】また、本発明の実施の形態２において、信号合成手段７では、複数の画素からなるブロックを設け、このブロック内の特定の位置、例えばブロックの中心位置に対応するlong輝度信号レベルから図１８に示した方法で求まる合成係数をブロック内の各画素の合成処理に用いる構成も考えられる。この場合、合成係数を画素毎に求める必要がなく、処理を簡略化できる。なお、合成係数を求める際に使用する画素の位置はブロックの中心位置に限る必要はない。また、本発明の実施の形態２において、信号合成手段７では、合成係数ｋはlong輝度信号ではなくフレーム画像に変換したshort信号から抽出される輝度信号（short輝度信号）から求める構成も考えられる。また、フレーム画像に変換したshort信号から抽出される輝度信号ではなく、フィールド画像であるshort信号から抽出される輝度信号から合成係数ｋを求める構成も考えられる。この場合、図１２からわかるようにlong信号の偶数ラインに対応するshort信号は存在しないため、このままでは合成係数を決定することができない。この場合、long信号の偶数ラインに対応する位置の合成係数は周辺のshort輝度信号もしくは周辺の合成係数から求めればよい。

【０１２９】また、本発明の実施の形態２において信号レベルから合成係数ｋを求める方法の例を図１８に示したが、合成係数ｋの決定方法はこれに限るものではなく、例えば図３９に示すように輝度レベルに応じて非線形にｋを決定する方法も考えられる。また、本発明の実施の形態３において、short信号はフィールド読み出しモードで読み出した１フィールド画像としたがこれに限るものではなく、一例としては、図３３にあげたように垂直方向に水平ライン信号を間引いて読み出す構成も考えられる。この場合、short信号は固体撮像素子上で上下２つのホトダイオードに蓄積された電荷が混合されずに読み出されるため、例えば図４０に示すような構成とすればよい。図４０に示した構成ではshort信号の上下２画素混合を２水平ライン加算手段２７（２水平ライン加算手段７０１と同様の手段であるが、区別するために付番を２７とする）において行うため、結果的には図２０に示した構成と同様の機能、効果を実現できる。但し、輝度信号補間手段１２においてはshort信号の間引かれ方に応じて、補間処理の内容が変わることは言うまでもない。例えばshort信号が図３０に示したように間引かれた信号の場合、例えば図４１に示すようにshort輝度信号（図４１(c)）の各水平ライン間に２ラインづつの補間水平ライン信号を内挿により作成すればよい。また補間手段７０２においても同様にshort信号の間引かれ方に応じて、必要な水平ライン信号を作成すればよいことは言うまでもない。なお、図３３にあげたように垂直方向に水平ライン信号を間引いて読み出す構成の場合、図４０に２水平ライン加算手段７０１及び２７の２つの２水平ライン加算手段を持つ構成を示したがこれに限るものではなく、２水平ライン加算手段７０１及び２７を持たない構成も考えられる。この場合、輝度信号抽出手段７０４０１に２水平ライン加算手段７０１及び２７と同様の効果を有する手段を包含させることでlong信号とshort信号からの輝度抽出が可能である。またこのような２水平ライン加算手段７０１、２７を有さない構成は、固体撮像素子３上に形成された色フィルターが例えばレッド（R）、グリーン（G）、ブルー（B）の原色からなり、一般に固体撮像素子３のホトダイオード上の電荷を混合せずに輝度信号と色信号を得る撮像方式においても有効である。また、本発明の実施の形態３及び本発明の実施の形態４において、露光量の異なる２つの信号は１フィールド画像であるshort信号と１フレーム画像であるlong信号としたがこれに限るものではなく、固体撮像装置の用途によっては１フィールド画像であるlong信号と１フレーム画像であるshort信号としてもよい。この場合、long信号から得られるlong輝度信号に対し輝度信号補間手段１２により垂直方向の補間処理を行い、補間処理後のlong輝度とshort輝度信号を輝度信号合成手段１３において合成すればよく、その際に使用する合成係数は補間処理後のlong輝度信号から求めればよ

い。また、本発明の実施の形態１及び本発明の実施の形態２と同様に補間処理前のlong輝度信号から抽出された輝度信号から合成係数を求める構成も考えられる。このように、１フィールド画像であるlong信号と１フレーム画像であるshort信号から合成信号を求めることで、高輝度部での解像度の高いダイナミックレンジ拡大画像が撮影可能である。また、本発明の実施の形態３において、補間手段７０２は１ラインメモリを２個使用し、２水平ライン分の信号から補間処理を行う構成としたがこれに限るものではなく、例えば更に多数の１ラインメモリを用いて、更に多数の水平ライン信号から高次の内挿処理により補間処理を行う構成も考えられる。また、入力される１水平ラインを２回ずつ繰り返し出力することで水平ライン数を２倍にするいわゆる前値補間を行う構成も考えられる。

【０１３０】また、本発明の実施の形態３及び本発明の実施の形態４において、輝度信号補間手段１２は２水平ライン信号の加算平均値を補間信号としたがこれに限るものではなく、例えば更に多数の水平ライン信号から高次の内挿処理により補間処理を行う構成や、前値補間により補間信号を得る構成も考えられる。

【０１３１】また、本発明の実施の形態３及び本発明の実施の形態４において、輝度信号合成手段１３においてlong輝度信号とshort輝度信号を合成するための合成係数ｋはlong輝度信号の画素毎に求めるものとしたがこれに限るものではなく、例えば、複数の画素のlong輝度信号レベルの平均値もしくは最小値もしくは最大値もしくは中間値から画素毎の合成係数ｋを求める構成や、画素毎に求められたｋの値のうち複数個のｋの値の平均値もしくは最小値もしくは最大値もしくは中間値を画素毎の合成係数とする構成も考えられる。

【０１３２】また、本発明の実施の形態３及び本発明の実施の形態４において、輝度信号合成手段１３では、複数の画素からなるブロックに対して合成係数を求めて合成を行う構成も考えられる。例えば図４３において、long輝度信号YL11とYL12、YL13とYL14をそれぞれ１ブロックとし、これと同位置に存在するshort輝度信号YS11とYS12、YS13とYS14をそれぞれ１ブロックとすると、この２画素単位のブロック毎に合成係数を求め、合成を行うことも可能であり、このとき例えばlong輝度信号YL11とYL12からなるブロックとshort輝度信号YS11とYS12の合成は、このブロックの合成係数をkb11とするとそれぞれ（数１９）のように行う。（YMは合成後の輝度信号）。

【０１３３】

【数１９】

$$YM11 = (1 - kb\ 11) \times YL11 + kb\ 11 \times YS11 \times D$$
$$YM12 = (1 - kb\ 11) \times YL12 + kb\ 11 \times YS12 \times D$$

【０１３４】この場合、合成係数kb11はブロックに対応するlong輝度信号（例えば図４３中のY11とY12）のいずれかの信号レベル、もしくはブロックに対応するlong輝度信号の平均値、最大値、最小値、中間値の少なくともいずれかから図１８に示した方法で求まるｋをブロックの合成係数kb11とすればよい。また、ブロックに対応するlong輝度信号の各信号レベルから図１８に示した方法で求められる画素毎のｋの値（例えば図４３中のｋ１、ｋ２）の平均値、最大値、最小値、中間値のいずれかをブロックの合成係数kb11とする構成も考えられる。なおブロック内の画素数は２画素と限らないことはいうまでもない。

【０１３５】また、本発明の実施の形態３及び本発明の実施の形態４において、輝度信号合成手段１３では、複数の画素からなるブロックを設け、このブロック内の特定の位置、例えばブロックの中心位置に対応するlong輝度信号レベルから図１８に示した方法で求まる合成係数をブロック内の各画素の合成処理に用いる構成も考えられる。この場合、合成係数を画素毎に求める必要がなく、処理を簡略化できる。なお、合成係数を求める際に使用する画素の位置はブロックの中心位置に限る必要はない。

【０１３６】また、本発明の実施の形態３及び本発明の実施の形態４において、信号合成手段１４及び２３では、long信号とshort信号を合成するための合成係数ｋはlong輝度信号から合成係数発生手段１３０１により画素毎に求められた値を用いるものとしたがこれに限るものではなく、例えば図４２に示すように信号合成手段１４及び２３の内部に合成係数発生手段１４０４を独自に備え、複数の画素のlong輝度信号レベルの平均値もしくは最小値もしくは最大値もしくは中間値から画素毎の合成係数ｋを求める構成や、画素毎に求められたｋの値のうち複数個から求めたｋの平均値もしくは最小値もしくは最大値もしくは中間値を画素毎の合成係数とする構成も考えられる。なおここで、合成係数発生手段１４０４の機能は合成係数発生手段１３０１と同様である。

【０１３７】また、本発明の実施の形態３及び本発明の実施の形態４において、信号合成手段１４及び２３では、複数の画素からなるブロックに対して合成係数を求めて合成を行う構成も考えられる。例えば図３８において、long信号(Ye+Mg)L11と(Cy+G)L12、(Ye+Mg)L13と(Cy+G)L14をそれぞれ１ブロックとし、これと同位置に存在するshort信号(Ye+Mg)S11と(Cy+G)S12、(Ye+Mg)S13と(Cy+G)S14をそれぞれ１ブロックとすると、この２画素単位のブロック毎に合成係数を求め、合成を行うことも可能であり、このとき例えばlong信号(Ye+Mg)L11と(Cy+G)L12からなるブロックとshort信号(Ye+Mg)S11と(Cy+G)S12の合成は、このブロックの合成係数をkb11とすると（数１８）のように行う。この場合、合成係数kb11は各ブロックと空間的に同じ位置に存在するlong輝度信号（例えば図３８中のYL11とYL12）のいずれかの信号レベル、もしくはブロックと空間的に同じ位置に存在するlong輝度信号の平均値、最大値、最小値、中間値の少なく

ともいずれかから図１８に示した方法で求まるｋをブロックの合成係数kb11とすればよい。また、ブロックと空間的に同じ位置に存在するlong輝度信号の各信号レベルから図１８に示した方法で求められる画素毎のｋの値（例えば図３８中のｋ１、ｋ２）の平均値、最大値、最小値、中間値のいずれかをブロックの合成係数kb11とする構成も考えられる。なおブロック内の画素数は２画素と限らないことはいうまでもない。

【０１３８】また、本発明の実施の形態３及び本発明の実施の形態４において、信号合成手段１４及び２３では、複数の画素からなるブロックを設け、このブロック内の特定の位置、例えばブロックの中心位置と空間的に同じ位置に存在するlong輝度信号レベルから図１８に示した方法で求まる合成係数をブロック内の各画素の合成処理に用いる構成も考えられる。この場合、合成係数を画素毎に求める必要がなく、処理を簡略化できる。なお、合成係数を求める際に使用する画素の位置はブロックの中心位置に限る必要はない。

【０１３９】また、本発明の実施の形態３及び本発明の実施の形態４において、信号合成手段１４及び２３で使用する合成係数ｋは上記方法でlong輝度信号から得られた値に一定の係数を乗算、もしくは一定の係数を加減算した値とする構成も考えられる。

【０１４０】また、本発明の実施の形態３及び本発明の実施の形態４において、輝度信号合成手段１３、信号合成手段１４及び２３では、合成係数ｋはlong輝度信号ではなくフレーム画像に変換したshort信号から抽出される輝度信号（short輝度信号）から求める構成も考えられる。また、フレーム画像に変換したshort信号から抽出される輝度信号ではなく、フィールド画像であるshort信号から抽出される輝度信号から合成係数ｋを求める構成も考えられる。この場合、図１２からわかるようにlong信号の偶数ラインに対応するshort信号は存在しないため、このままでは合成係数を決定することができない。この場合、long信号の偶数ラインに対応する位置の合成係数は周辺のshort輝度信号もしくは周辺の合成係数をそのまま用いるか、もしくは周辺の合成係数の平均値もしくは最大値もしくは最小値もしくは中間値から求めれる方法等が考えられる。その他、周辺の合成係数とその位置関係から補間処理により求める方法も考えられる。

【０１４１】また、本発明の実施の形態３及び本発明の実施の形態４において輝度信号レベルから合成係数ｋを求める方法の例を図１８に示したが、合成係数ｋの決定方法はこれに限るものではなく、例えば図３９に示すように輝度レベルに応じて非線形にｋを決定する方法も考えられる。また、本発明の実施の形態４において、short信号はフィールド読み出しモードで読み出した１フィールド画像としたがこれに限るものではなく、一例としては、図３３にあげたように垂直方向に水平ライン信号を間引いて読み出す構成も考えられる。この場合、short信号は固体撮像素子上で上下２つのホトダイオードに蓄積された電荷が混合されずに読み出されるため、例えば図４０と同様に２水平ライン加算手段によりshort信号の上下２画素混合を行うようにすれば、結果的には図３０に示した構成と同様の機能、効果を実現できる。但し、本発明の実施の形態３と同様に輝度信号補間手段１２においてはshort信号の間引かれ方に応じて、補間処理の内容が変わることは言うまでもない。また間引き手段２２においても同様にshort信号の間引かれ方に応じて、long信号がshort信号と同じ信号形式になるように間引きを行えばよいことは言うまでもない。

【０１４２】また、本発明の実施の形態４においては間引き手段２２によりlong信号の垂直方向の間引き処理を行う構成を説明したが、図４４に示すように画像信号から水平方向に画素を間引く機能を持つ水平方向間引き手段２７を設け、これにより２水平ライン加算手段７０１を経たlong信号とshort信号の両者の水平方向の画素を例えば１/２に間引くような構成も考えられる。この場合、上記のように水平方向の画素を１/２に間引けば、同時化処理のための１ラインメモリ１５、１６をその半分の容量の０．５ラインメモリ２８、２９に置き換えることが可能である。このように水平方向にも画素を間引くことで本発明の固体撮像装置の構成を更に簡略化し安価にすることが可能である。その場合、水平方向の間引き処理を行う前にlong信号及びshort信号の水平方向の帯域制限を行っておけば、間引き処理により不要な折り返しが発生しない。同様に垂直方向にも帯域制限を施せば、垂直方向の間引き処理に際しても不要な折り返しを回避可能であることは言うまでもない。

【０１４３】また上記すべての本発明の実施の形態において、long信号とshort信号は一旦画像メモリ６に記憶することとしたがこれに限るものではなく、例えばlong信号もしくはshort信号のいづれか一方のみ画像メモリ６に記憶させ、残りの片方の信号の固体撮像素子３からの読み出しと画像メモリ６からの信号読み出しを同期させて合成の処理を行う方法も考えられる。この場合、画像メモリ６の容量を削減でき、更に安価に固体撮像装置を構成可能である。

【０１４４】また上記すべての本発明の実施の形態において、固体撮像素子３上に形成されるカラーフィルター配列は図３に示すようなマゼンタ、グリーン、イエロー、シアンの４色からなる補色市松タイプを用いて説明したがこれに限るものではなく、一例をあげるならば、図４５に示すようなマゼンタ(Mg)とグリーン(G)がライン毎に位置反転しない配置や、図４６に示すようなグリーン（G）とシアン（Cy）、イエロー（Ye）の２つの補色フィルタをストライプ状に配置する構成も考えられる。

【０１４５】また上記すべての本発明の実施の形態にお

いて、固体撮像素子３上に形成されるカラーフィルター配列は図３に示すようなマゼンタ、グリーン、イエロー、シアンの４色からなる構成を用いて説明したがこれに限るものではなく、グリーン（G）、ブルー（B）、レッド（R）からなる原色フィルタを用いた構成も考えられ、そのフィルター配置として一例をあげるならば、図４７に示したベイヤー方式、図４８に示したインタライン方式、図４９に示したGストライプRB完全市松方式、図５０に示したストライプ方式、図５１に示した斜めストライプ方式、図５２に示したGストライプRB線順次方式、図５３に示したGストライプRB点順次方式等が考えられる。このように原色フィルタを用いた場合に輝度信号は（数２０）に従い求められることは言うまでもない。

【０１４６】

【数２０】

輝度信号＝０．３×R＋０．５９×G＋０．１１×B

【０１４７】また上記すべての本発明の実施の形態において、固体撮像素子３上に形成されるカラーフィルター配列を図３に示すようなマゼンタ、グリーン、イエロー、シアンの４色からなる補色市松タイプとし、更にshort信号の読み出しをフィールド読み出しとして説明したため、long信号とshort信号の信号形式をあわせるために、２水平ライン加算手段７０１によるlong信号の上下２水平ライン加算処理を含む構成を示したがこれに限るものではなく、上記図４５～図５３に示したような他のフィルター配置を採用した場合や、フィールド読み出しではなく、図３３に示したような間引き読み出しを行う場合には、２水平ライン加算処理が必ずしも必要ではないことは言うまでもない。

【０１４８】また上記すべての本発明の実施の形態において、合成係数を求める際の閾値Th#max、Th#min、Th#max'、Th#min'をそれぞれ（数２１）のように設定し、長時間露光信号と短時間露光信号を重み付け加算ではなく、ある信号レベルを境に切り替える構成も考えられる。

【０１４９】

【数２１】

$$Th\_max = Th\_min$$
$$Th\_max' = Th\_min'$$

【０１５０】

【発明の効果】以上のように本発明によれば、固体撮像素子の露光及び信号読み出しモードを制御し、１フィールド分の短時間露光信号と１フレーム分の長時間露光信号を撮影しこれらを合成することで、固体撮像素子の画素数並みの解像度を持ちながらもダイナミックレンジが拡大された画像を撮影することができる。さらに本固体撮像装置で使用する固体撮像素子には、民生用固体撮像装置で一般に用いられているＩＴ－ＣＣＤが使用可能であるため、複数の固体撮像素子や特殊な固体撮像素子を使用する必要がなく、安価に装置を構成することができる。

【図面の簡単な説明】

【図１】本発明の実施の形態１による固体撮像装置を示すブロック図

【図２】本発明の実施の形態１における固体撮像素子３からの信号読み出しモードの説明図

【図３】本発明の実施の形態１における固体撮像素子３上に形成される色フィルタ配置の例を示す図

【図４】本発明の実施の形態１における信号合成手段７の構成を示すブロック図

【図５】本発明の実施の形態１における２水平ライン加算手段７０１の構成を示すブロック図

【図６】本発明の実施の形態１における補間手段７０２の構成を示すブロック図

【図７】本発明の実施の形態１における重み付け加算手段７０３の構成を示すブロック図

【図８】本発明の実施の形態１におけるダイナミックレンジ拡大の原理を説明する説明図

【図９】本発明の実施の形態１におけるlong信号、short信号の露光及び読み出しタイミングを説明するための説明図

【図１０】本発明の実施の形態１におけるshort信号を説明するための説明図

【図１１】本発明の実施の形態１におけるlong信号を説明するための説明図

【図１２】本発明の実施の形態１における２水平ライン加算処理と補間処理を説明するための説明図

【図１３】本発明の実施の形態１における合成係数決定方法を説明するためのグラフ

【図１４】本発明の実施の形態１における信号合成処理の方法を説明するための説明図

【図１５】本発明の実施の形態２における重み付け加算手段７０４の構成を示すブロック図

【図１６】本発明の実施の形態２における輝度信号抽出手段７０４０１の構成を示すブロック図

【図１７】本発明の実施の形態２におけるlong輝度信号の作成方法を説明するための説明図

【図１８】本発明の実施の形態２における合成係数決定方法を説明するためのグラフ

【図１９】本発明の実施の形態２における信号合成処理の方法を説明するための説明図

【図２０】ｃ固体撮像装置を示すブロック図

【図２１】本発明の実施の形態３における輝度信号補間手段１２の構成を示すブロック図

【図２２】本発明の実施の形態３における輝度信号合成手段１３の構成を示すブロック図

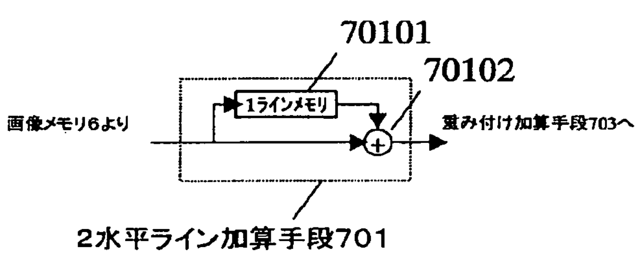
【図２３】本発明の実施の形態３における信号合成手段１４の構成を示すブロック図

【図２４】本発明の実施の形態３における同時化手段１

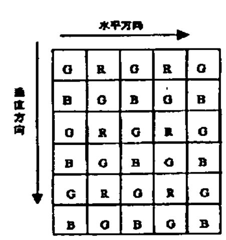
９の構成を示すブロック図
【図２５】本発明の実施の形態３におけるlong輝度信号を説明するための説明図
【図２６】本発明の実施の形態３におけるshort輝度信号を説明するための説明図
【図２７】本発明の実施の形態３における輝度信号の補間処理を説明するための説明図
【図２８】本発明の実施の形態３における輝度信号の合成方法を説明するための説明図
【図２９】本発明の実施の形態３における同時化手段１９による同時化処理を説明するための説明図
【図３０】本発明の実施の形態４における固体撮像装置を示すブロック図
【図３１】本発明の実施の形態４における同時化手段２４の構成を示すブロック図
【図３２】本発明の実施の形態３における同時化手段２４による同時化処理を説明するための説明図
【図３３】固体撮像素子３からの画像信号読み出し方法の別の例を示す説明図
【図３４】本発明の実施の形態１においてlong信号をフィールド画、short信号をフレーム画とした場合の２水平ライン加算処理と補間処理を説明するための説明図
【図３５】前値補間処理を説明するための説明図
【図３６】本発明の実施の形態１におけるlong信号とshort信号の合成方法の別の例を示す説明図
【図３７】本発明の実施の形態１におけるlong信号レベルから合成係数を決定する方法の別の例を示すグラフ
【図３８】本発明の実施の形態２におけるlong信号とshort信号の合成方法の別の例を示す説明図
【図３９】本発明の実施の形態２におけるlong輝度信号レベルから合成係数を決定する方法の別の例を示すグラフ
【図４０】本発明の実施の形態３においてshort信号の読み出し方法を変えた場合の固体撮像装置のブロック図
【図４１】本発明の実施の形態３においてshort信号の読み出し方法を変えた場合の輝度信号補間処理の内容を説明するための説明図　＊

＊【図４２】本発明の実施の形態３において信号合成手段１４の別の構成を示すブロック図
【図４３】本発明の実施の形態３及び本発明の実施の形態４におけるlong輝度信号とshort輝度信号の合成方法の別の例を示す説明図
【図４４】本発明の実施の形態４における固体撮像装置の別の例を示すブロック図
【図４５】固体撮像素子３上に形成される色フィルタ配置の別の例を示す図
【図４６】固体撮像素子３上に形成される色フィルタ配置（CyYeGストライプ方式）の別の例を示す図
【図４７】固体撮像素子３上に形成される色フィルタ配置（ベイヤー方式）の別の例を示す図
【図４８】固体撮像素子３上に形成される色フィルタ配置（インタライン方式）の別の例を示す図
【図４９】固体撮像素子３上に形成される色フィルタ配置（Gストライプ RB完全市松方式）の別の例を示す図
【図５０】固体撮像素子３上に形成される色フィルタ配置（ストライプ方式）の別の例を示す図
【図５１】固体撮像素子３上に形成される色フィルタ配置（斜めストライプ方式）の別の例を示す図
【図５２】固体撮像素子３上に形成される色フィルタ配置（Gストライプ RB線順次方式）の別の例を示す図
【図５３】固体撮像素子３上に形成される色フィルタ配置（Gストライプ RB点順次方式）の別の例を示す図
【符号の説明】
１　光学レンズ
２　機械シャッター
３　固体撮像素子
４　アナログ信号処理手段
５　Ａ／Ｄ変換手段
６　画像メモリ
７　信号合成手段
８　デジタル信号処理手段
９　シャッター駆動制御手段
１０　固体撮像素子駆動制御手段
１１　システム制御手段

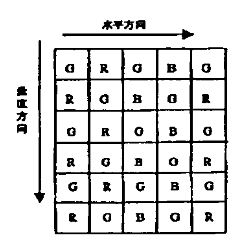
【図５】



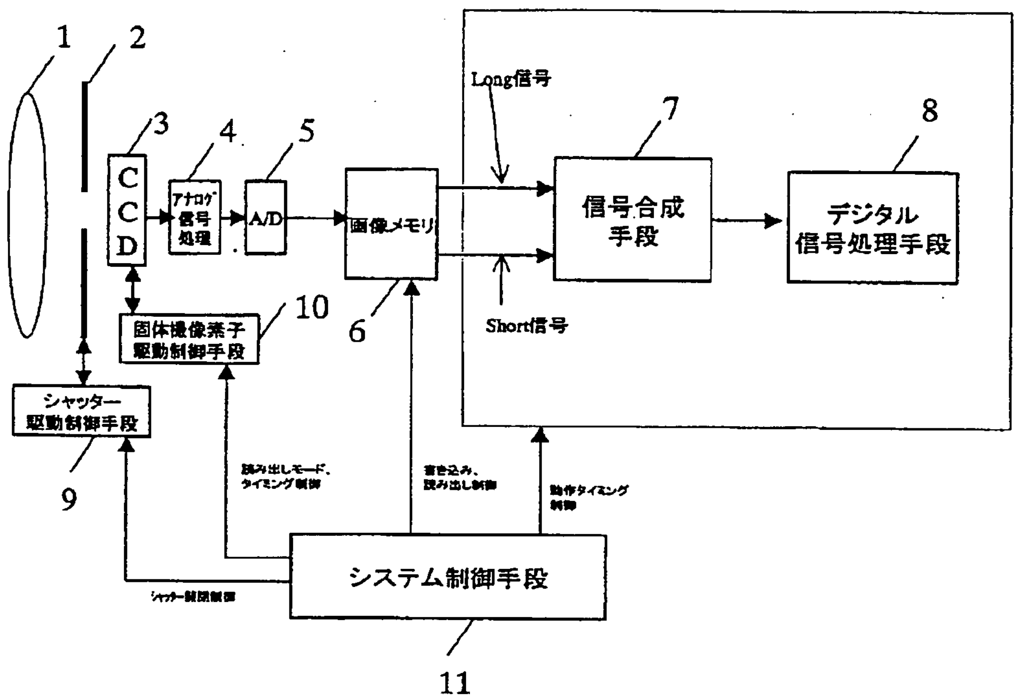
【図４７】



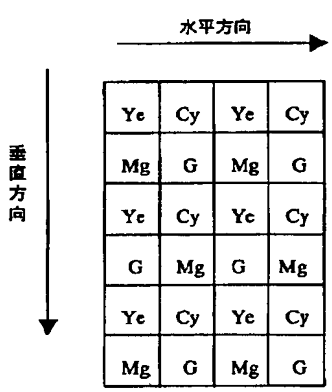
【図４８】



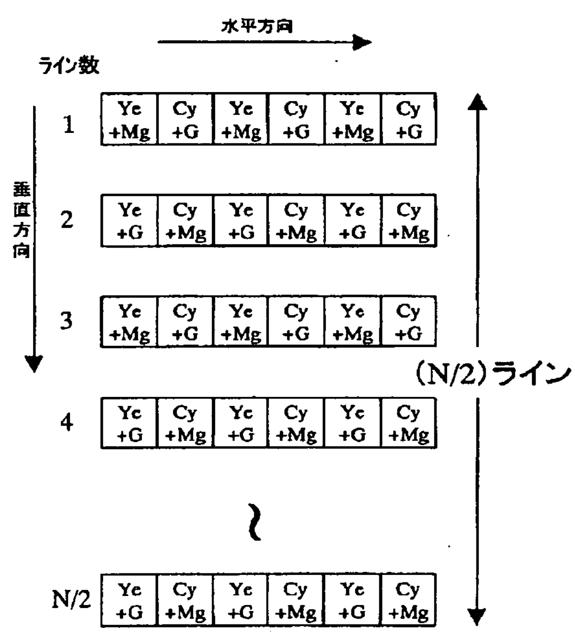
【図１】



【図３】

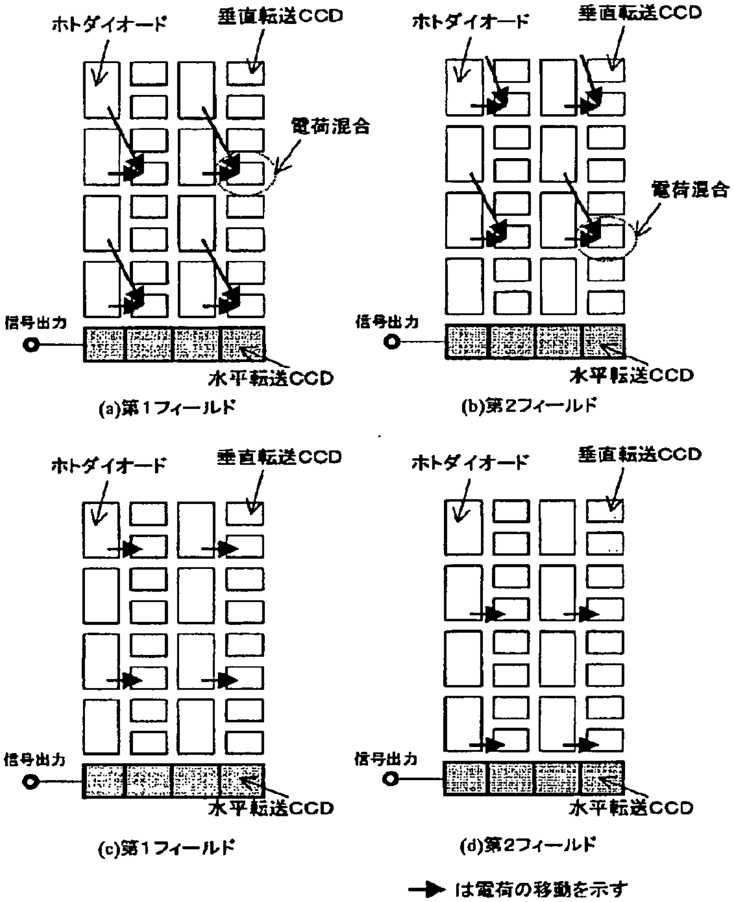


【図１０】

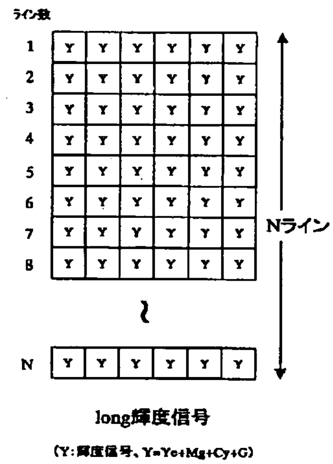


short信号

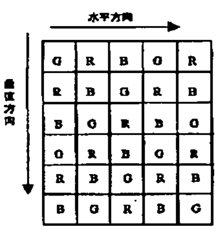
【図２】



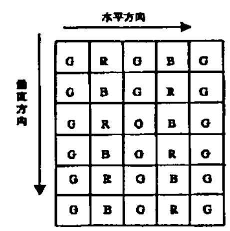
【図２５】



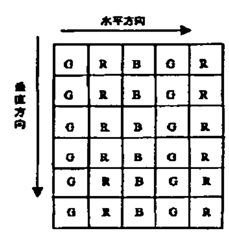
【図５１】



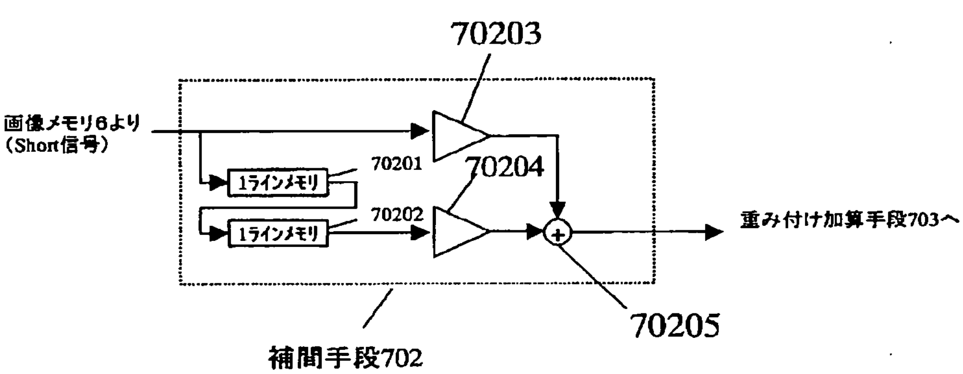
【図４９】



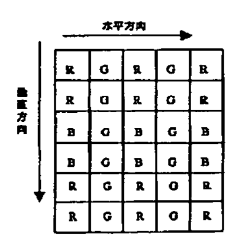
【図５０】



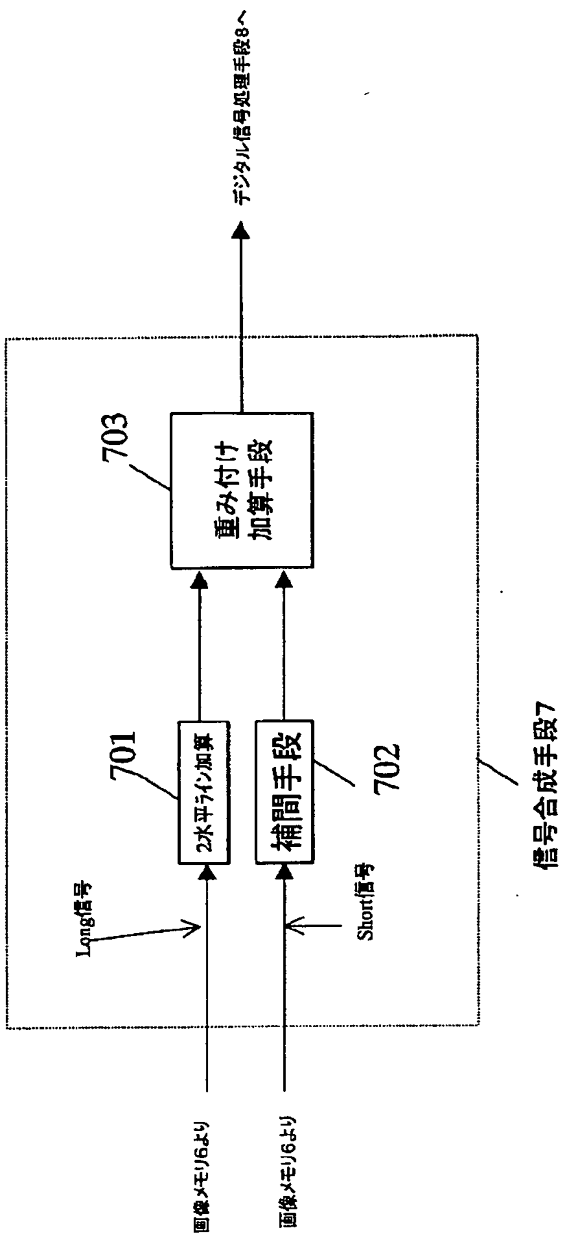
【図６】



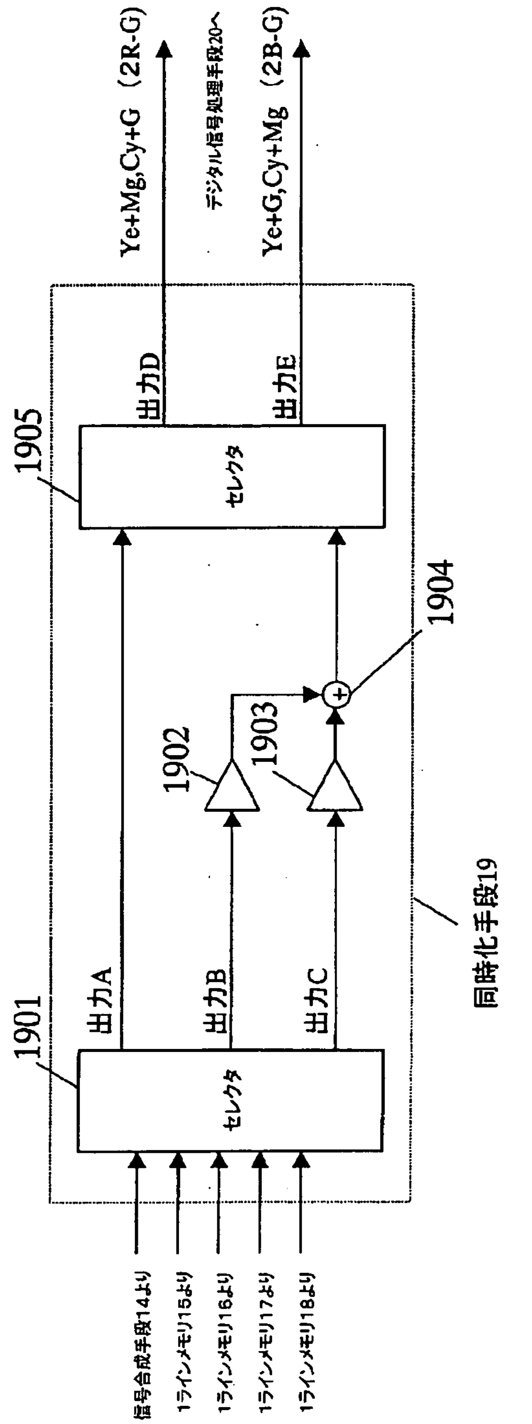
【図５２】



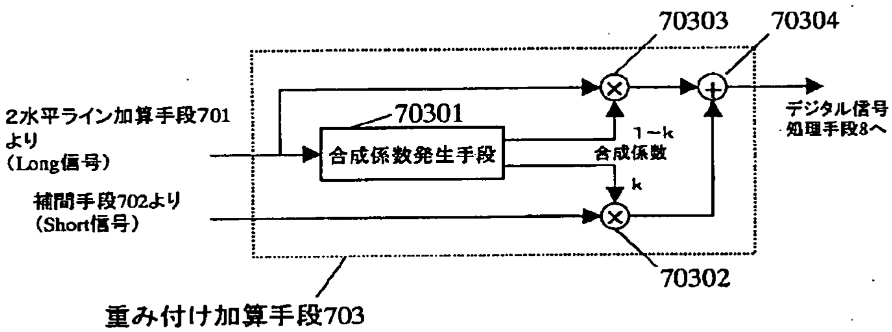
【図４】


デジタル信号処理手段8へ
703
重み付け
加算手段
701
2水平ライン加算
補間手段
702
Long信号
Short信号
信号合成手段7
画像メモリ6より
画像メモリ6より

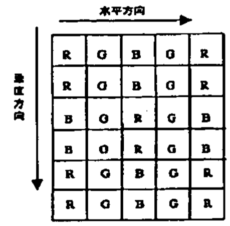
【図２４】


Ye+Mg,Cy+G（2R-G）
デジタル信号処理手段20へ
Ye+G,Cy+Mg（2B-G）
出力D
出力E
1905
セレクタ
1904
1902
1903
出力A
出力B
出力C
1901
セレクタ
同時化手段19
信号合成手段14より
1ラインメモリ15より
1ラインメモリ16より
1ラインメモリ17より
1ラインメモリ18より

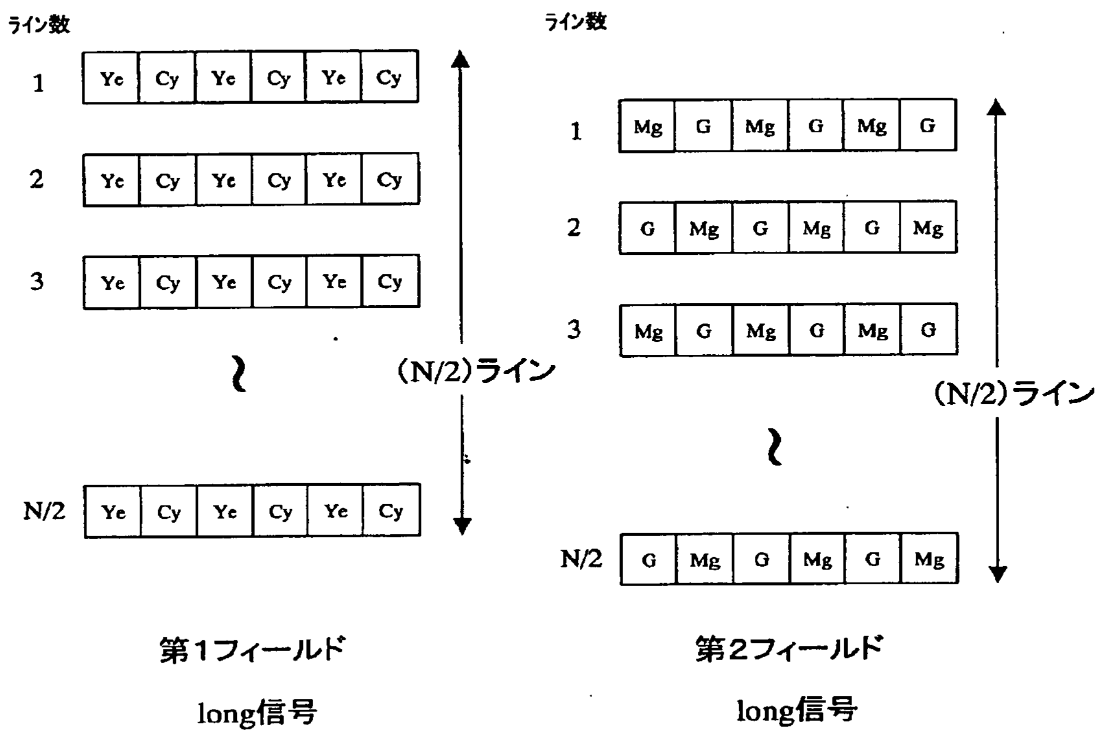
【図７】



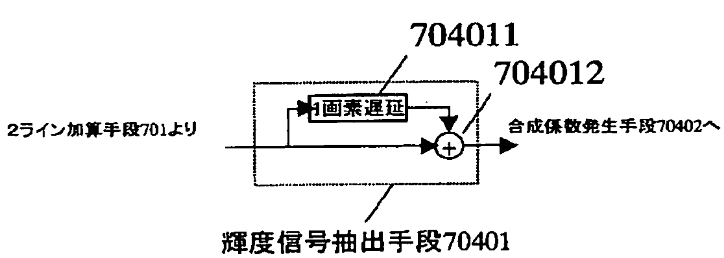
【図５３】



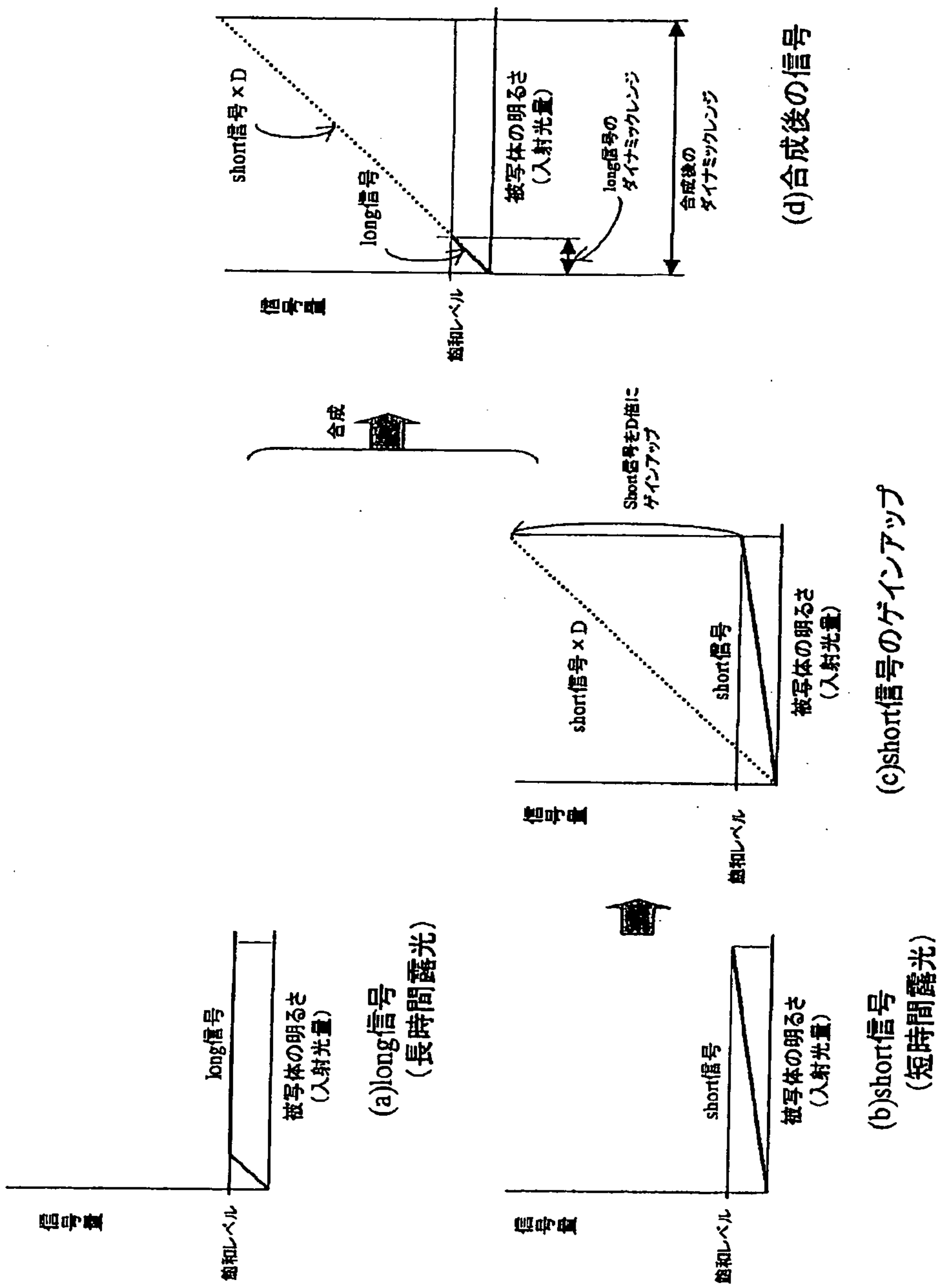
【図１１】



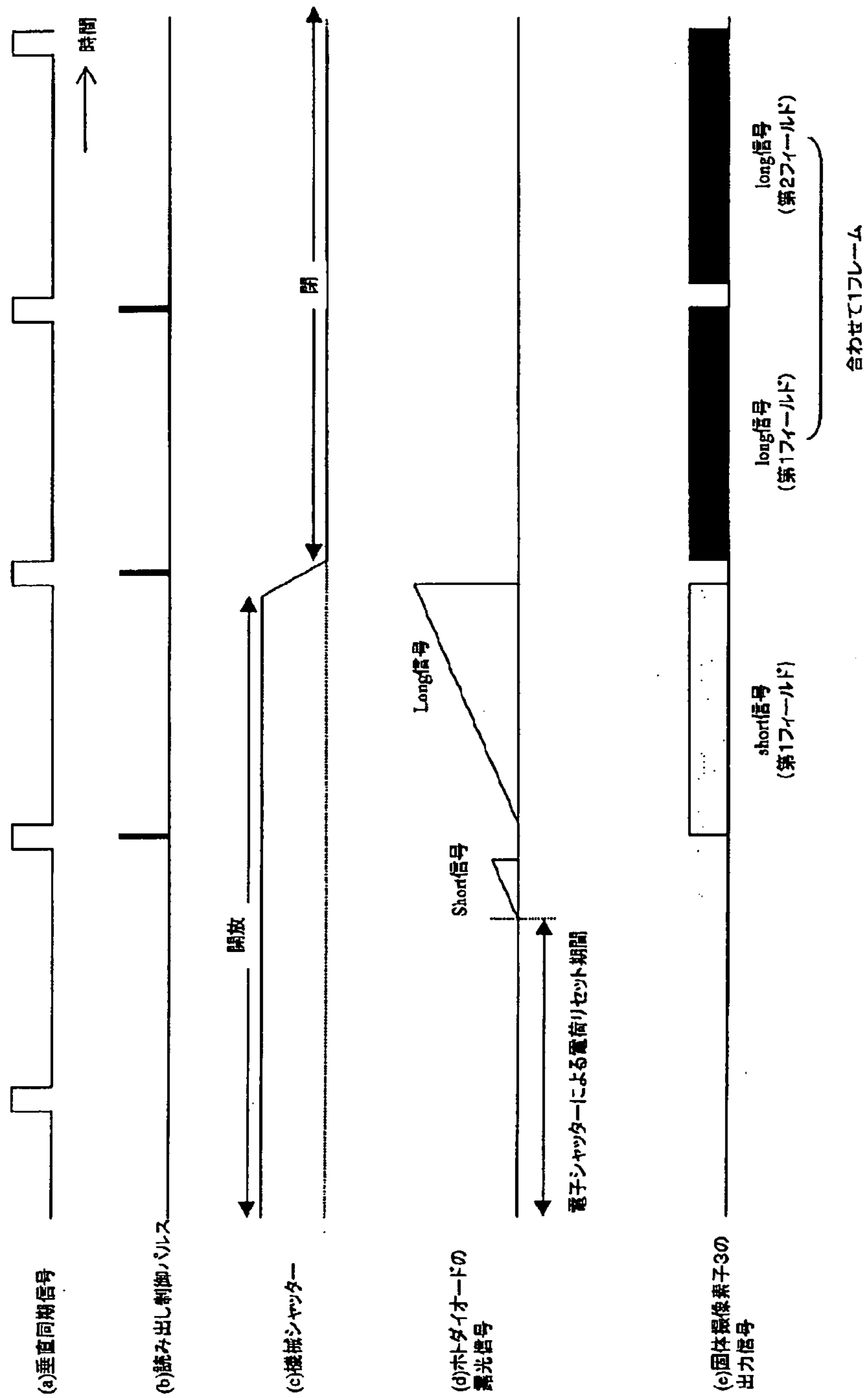
【図１６】



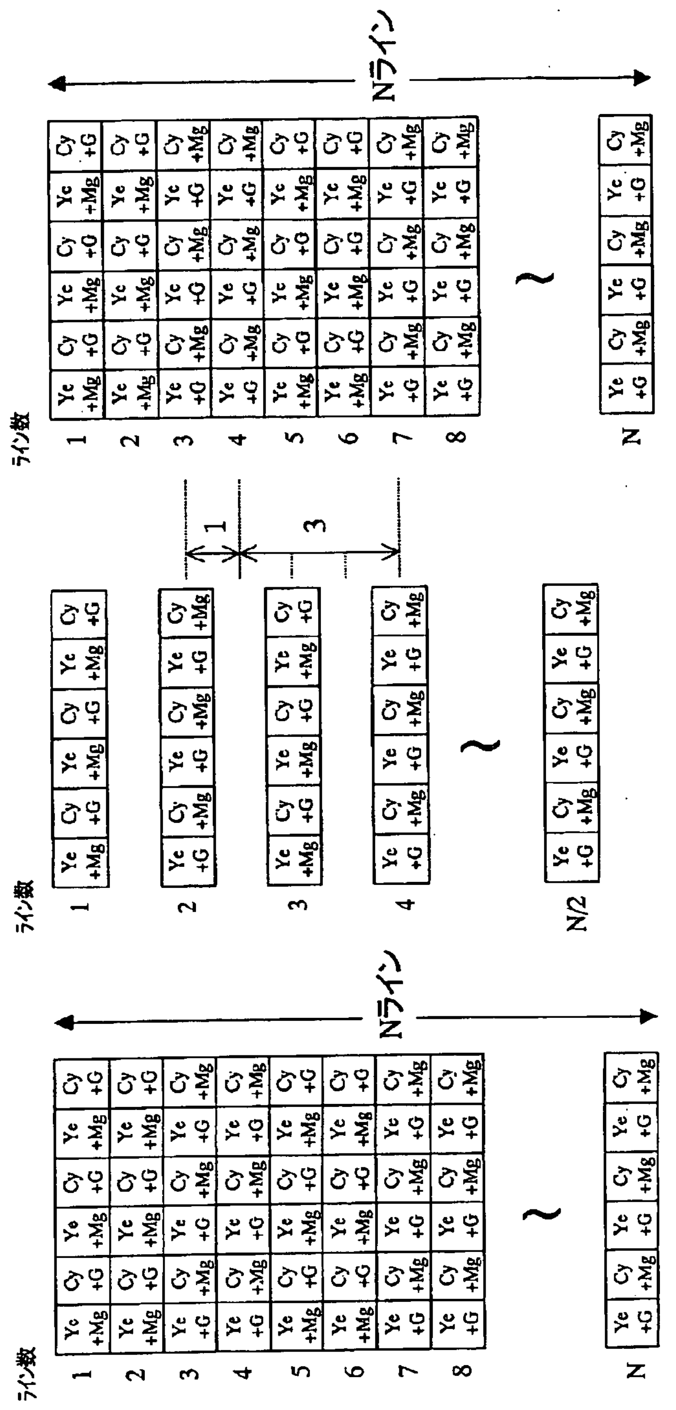
【図８】


信号量
飽和レベル
long信号
被写体の明るさ
（入射光量）
(a)long信号
（長時間露光）
short信号
(b)short信号
（短時間露光）
short信号ｘD
(c)short信号のゲインアップ
Short信号をD倍に
ゲインアップ
合成
long信号の
ダイナミックレンジ
合成後の
ダイナミックレンジ
(d)合成後の信号

【図９】


(a)垂直同期信号
時間
(b)読み出し制御パルス
(c)機械シャッター
閉
開放
(d)ホトダイオードの露光信号
Long信号
Short信号
電子シャッターによる電荷リセット期間
(e)固体撮像素子3の出力信号
long信号（第2フィールド）
long信号（第1フィールド）
short信号（第1フィールド）
合わせて1フレーム

【図１２】

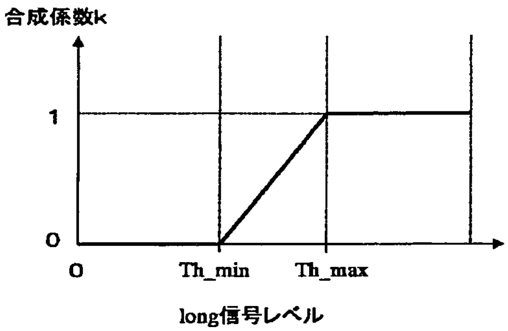


(a)上下2ライン加算後のlong信号

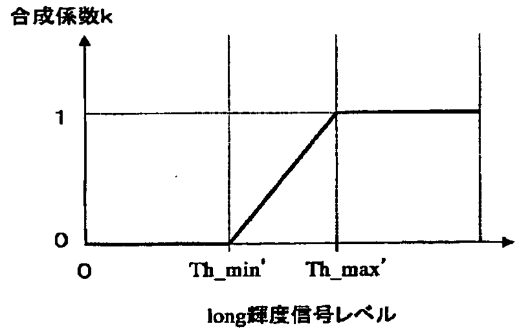
(b)short信号

(c)補間処理後のshort信号

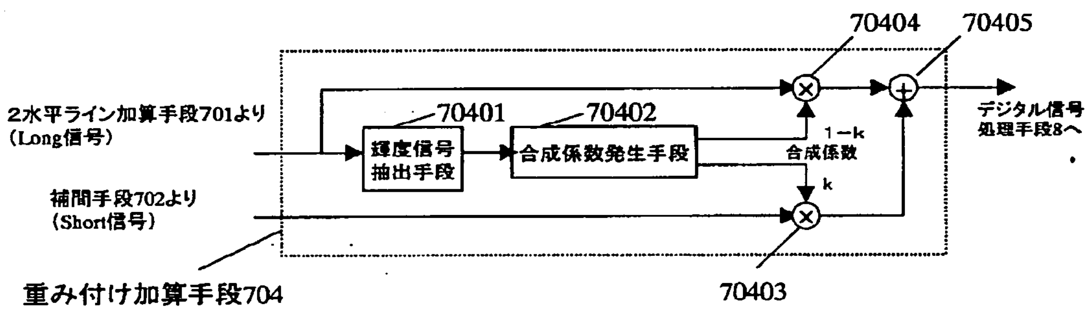
【図１３】



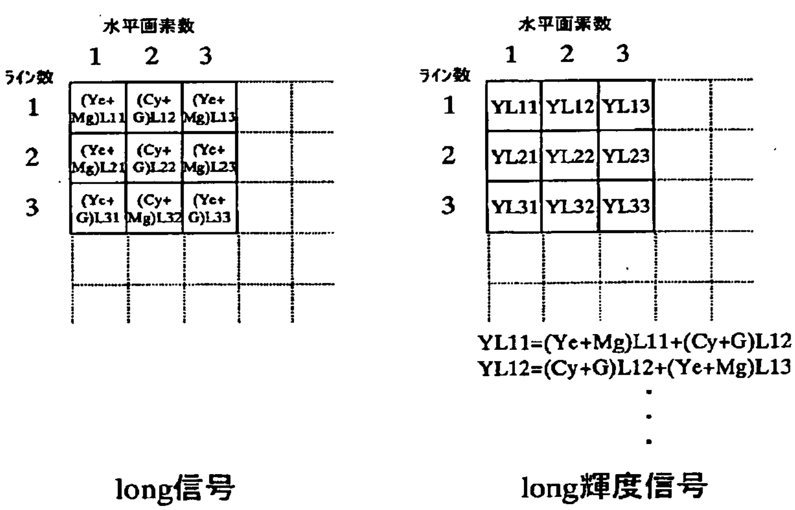
【図１８】



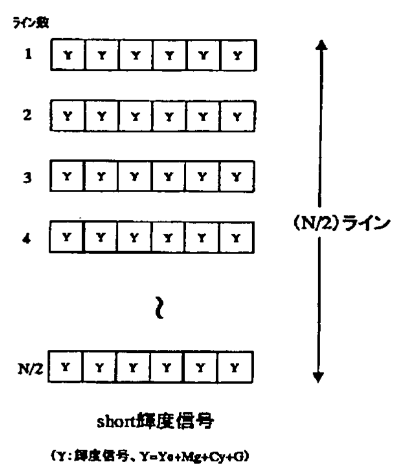
【図１５】



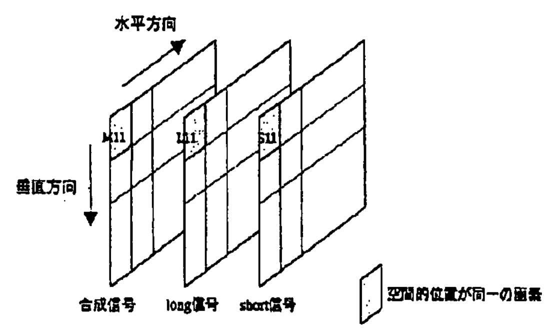
【図１７】



【図２６】



【図１４】



long信号

ライン数	水平画素数 1	2	3	
1	(Ye+Mg)L11	(Cy+G)L12	(Ye+Mg)L13	
2	(Ye+Mg)L21	(Cy+G)L22	(Ye+Mg)L23	
3	(Ye+G)L31	(Cy+Mg)L32	(Ye+G)L33	

short信号

ライン数	水平画素数 1	2	3	
1	(Ye+Mg)S11	(Cy+G)S12	(Ye+Mg)S13	
2	(Ye+Mg)S21	(Cy+G)S22	(Ye+Mg)S23	
3	(Ye+G)S31	(Cy+Mg)S32	(Ye+G)S33	

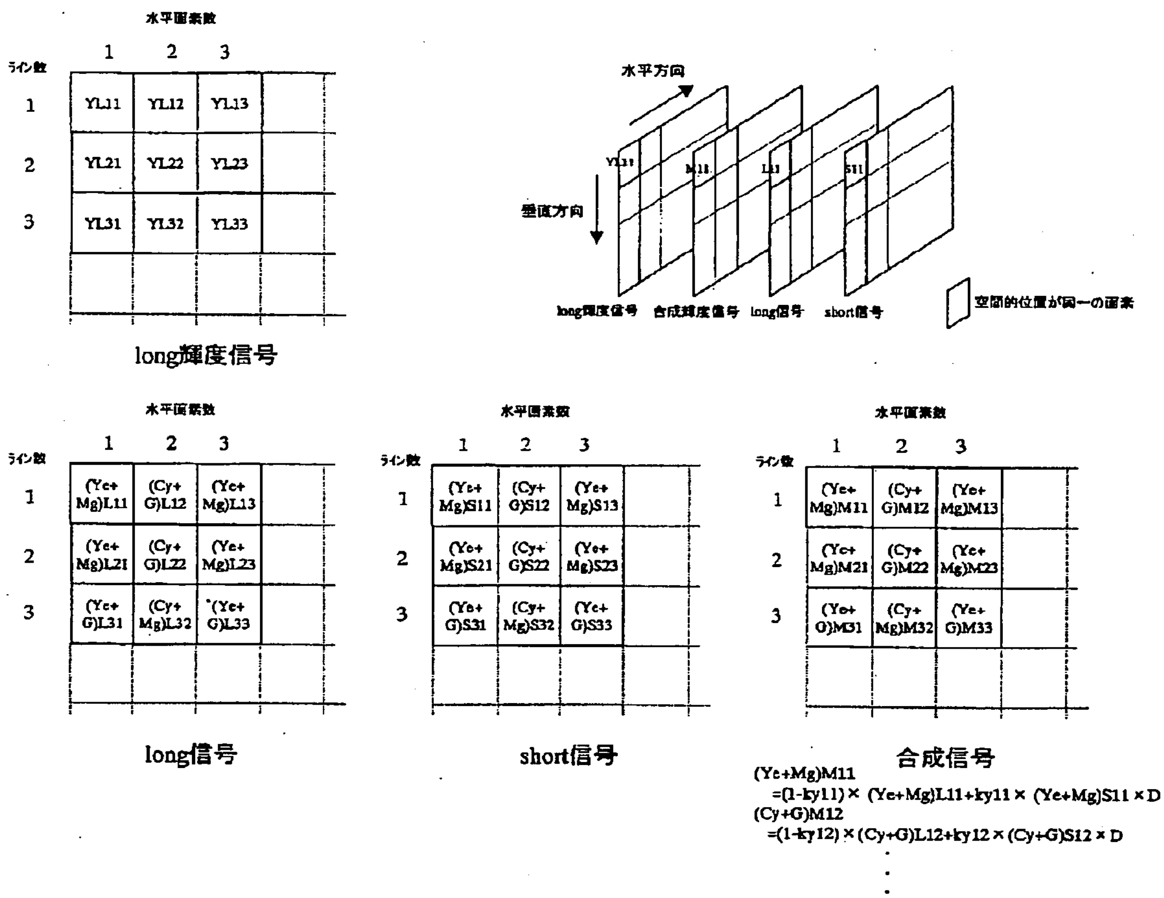
合成信号

ライン数	水平画素数 1	2	3	
1	(Ye+Mg)M11	(Cy+G)M12	(Ye+Mg)M13	
2	(Ye+Mg)M21	(Cy+G)M22	(Ye+Mg)M23	
3	(Ye+G)M31	(Cy+Mg)M32	(Ye+G)M33	

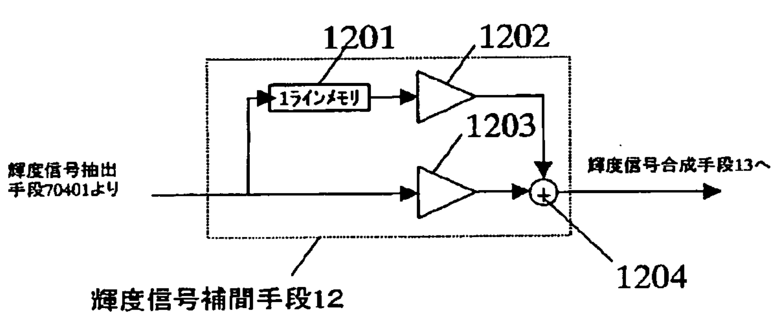
(Ye+Mg)L11から求められる合成係数＝k11
(Cy+G)L12から求められる合成係数＝k12

(Ye+Mg)M11=(1-k11)×(Ye+Mg)L11+k11×(Ye+Mg)S11×D
(Cy+G)M12=(1-k12)×(Cy+G)L12+k12×(Cy+G)S12×D
・
・
・

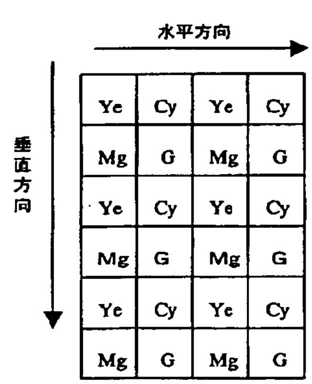
【図１９】


水平画素数
ライン数
YL11 YL12 YL13
YL21 YL22 YL23
YL31 YL32 YL33
long輝度信号
水平方向
垂直方向
long輝度信号 合成輝度信号 long信号 short信号
空間的位置が同一の画素
(Ye+Mg)L11 (Cy+G)L12 (Ye+Mg)L13
(Ye+Mg)L21 (Cy+G)L22 (Ye+Mg)L23
(Ye+G)L31 (Cy+Mg)L32 (Ye+G)L33
long信号
(Ye+Mg)S11 (Cy+G)S12 (Ye+Mg)S13
(Ye+Mg)S21 (Cy+G)S22 (Ye+Mg)S23
(Ye+G)S31 (Cy+Mg)S32 (Ye+G)S33
short信号
(Ye+Mg)M11 (Cy+G)M12 (Ye+Mg)M13
(Ye+Mg)M21 (Cy+G)M22 (Ye+Mg)M23
(Ye+G)M31 (Cy+Mg)M32 (Ye+G)M33
合成信号
(Ye+Mg)M11
=(1-ky11)× (Ye+Mg)L11+ky11× (Ye+Mg)S11×D
(Cy+G)M12
=(1-ky12)×(Cy+G)L12+ky12×(Cy+G)S12×D

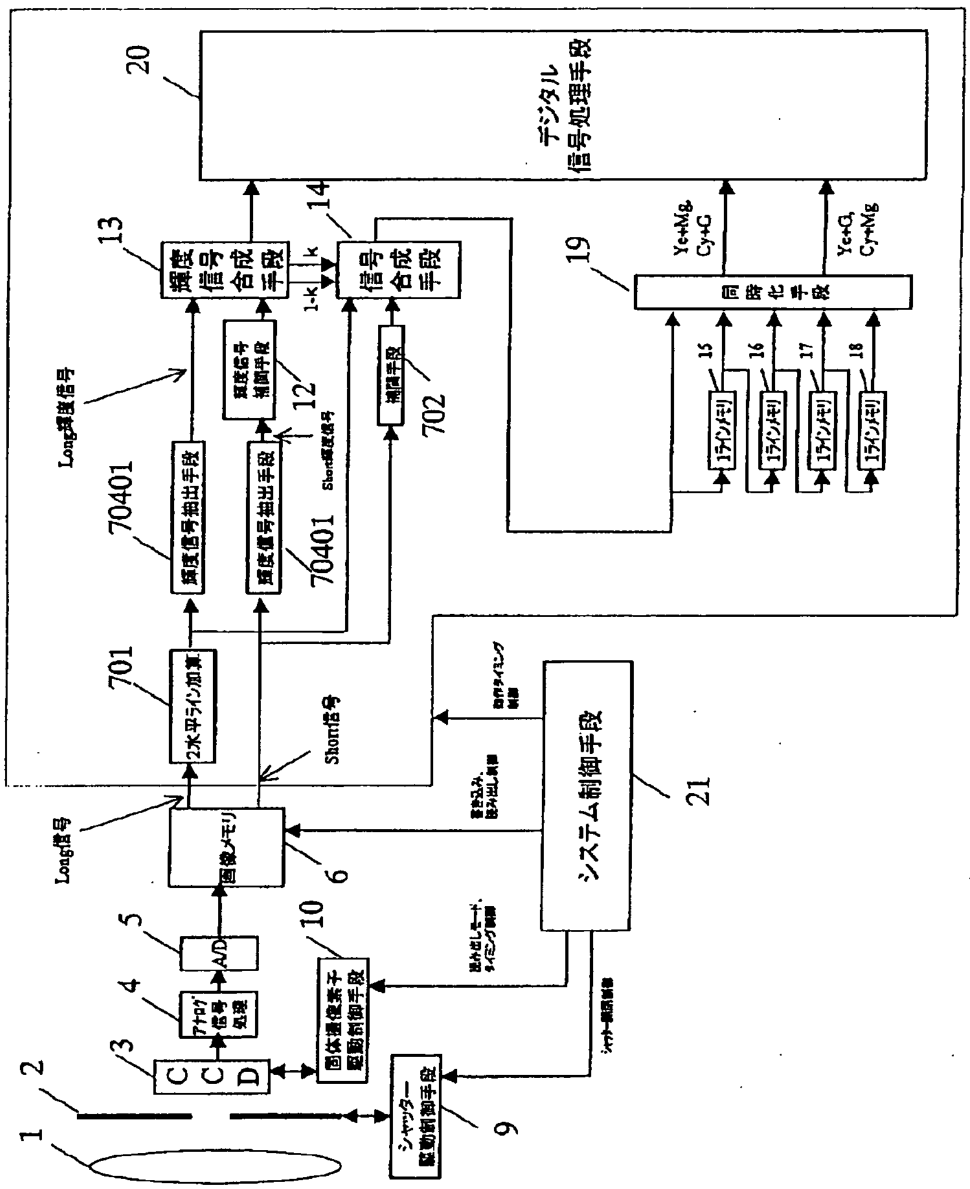
【図２１】


1201
1202
1203
1204
1ラインメモリ
輝度信号抽出手段70401より
輝度信号合成手段13へ
輝度信号補間手段12

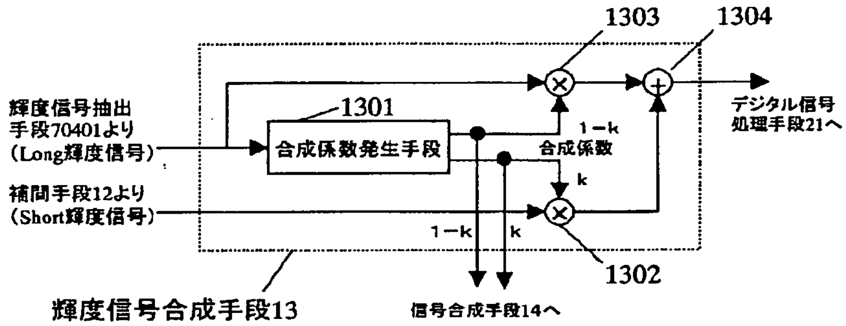
【図４５】


水平方向
垂直方向
Ye Cy Ye Cy
Mg G Mg G
Ye Cy Ye Cy
Mg G Mg G
Ye Cy Ye Cy
Mg G Mg G

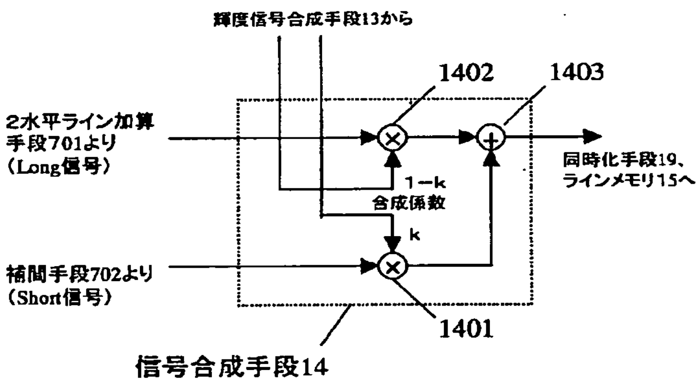
【図２０】


デジタル信号処理手段
輝度信号合成手段
信号合成手段
同時化手段
1ラインメモリ
輝度信号補間手段
補間手段
輝度信号抽出手段
2水平ライン加算
画像メモリ
A/D
CCD
固体撮像素子駆動制御手段
シャッター駆動制御手段
システム制御手段
Long信号
Short信号
Long輝度信号
Ye+Mg, Cy+G
Ye+G, Cy+Mg
k
1-k
20
13
14
19
12
70401
701
702
6
5
4
3
2
1
10
9
21
15
16
17
18

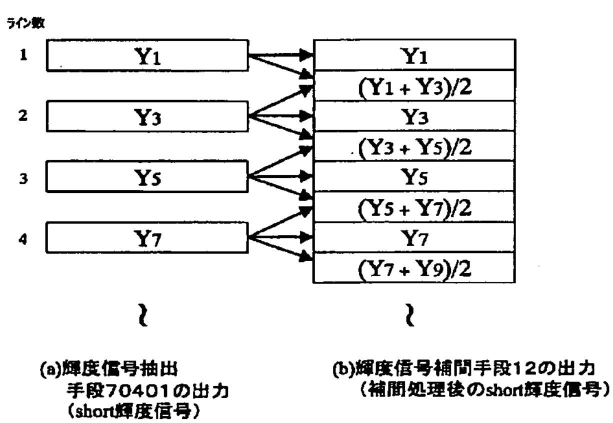
【図２２】



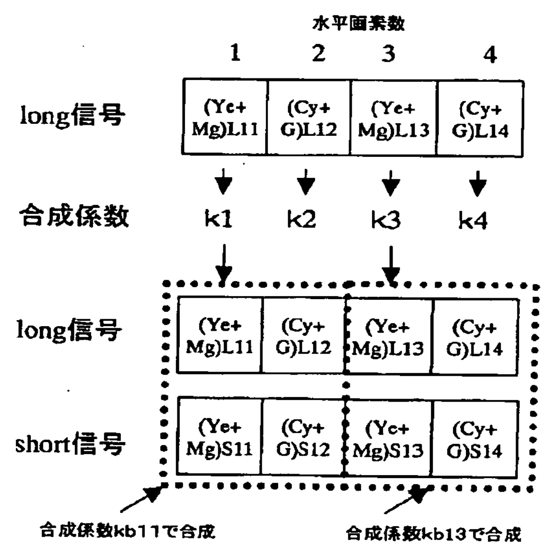
【図２３】



【図２７】



【図３６】



【図２８】

水平画素数 / ライン数

	1	2	3	4
1	YL11	YL12	YL13	YL14
2	YL21	YL22	YL23	YL24
3	YL31	YL32	YL33	YL34

long輝度信号

	1	2	3	4
1	YS11	YS12	YS13	YS14
2	YS21	YS22	YS23	YS24
3	YS31	YS32	YS33	YS34

short輝度信号

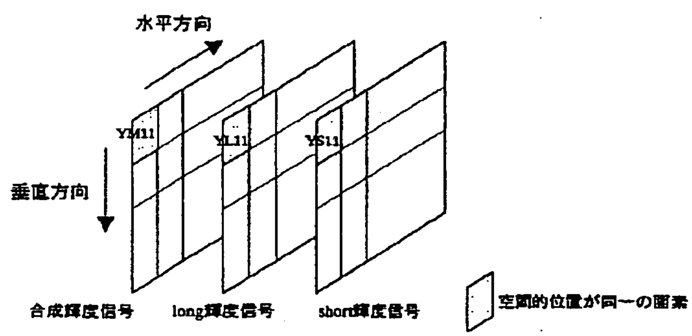
	1	2	3	4
1	YM11	YM12	YM13	YM14
2	YM21	YM22	YM23	YM24
3	YM31	YM32	YM33	YM34

$YM11=(1-k11)\times YL11+k11\times YS11\times D$

$YM12=(1-k12)\times YL12+k12\times YS12\times D$

$\vdots$

合成輝度信号



【図３２】

ライン数

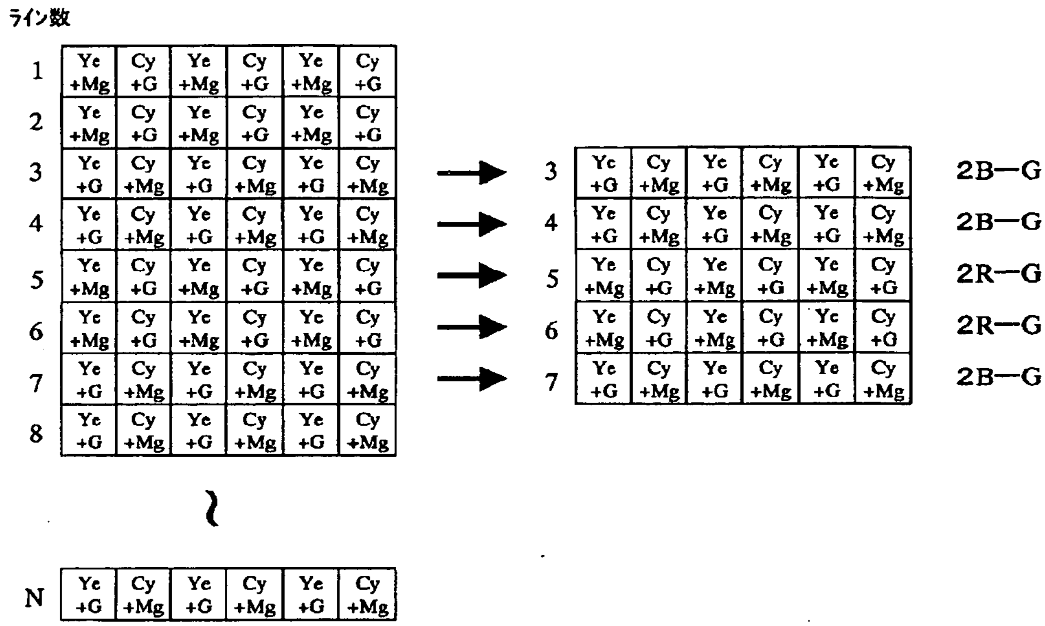
1	Ye+Mg	Cy+G	Ye+Mg	Cy+G	Ye+Mg	Cy+G
2	Ye+G	Cy+Mg	Ye+G	Cy+Mg	Ye+G	Cy+Mg
3	Ye+Mg	Cy+G	Ye+Mg	Cy+G	Ye+Mg	Cy+G
4	Ye+G	Cy+Mg	Ye+G	Cy+Mg	Ye+G	Cy+Mg

(a)合成信号

2	Ye+G	Cy+Mg	Ye+G	Cy+Mg	Ye+G	Cy+Mg	2B−G
3	Ye+Mg	Cy+G	Ye+Mg	Cy+G	Ye+Mg	Cy+G	2R−G
4	Ye+G	Cy+Mg	Ye+G	Cy+Mg	Ye+G	Cy+Mg	2B−G

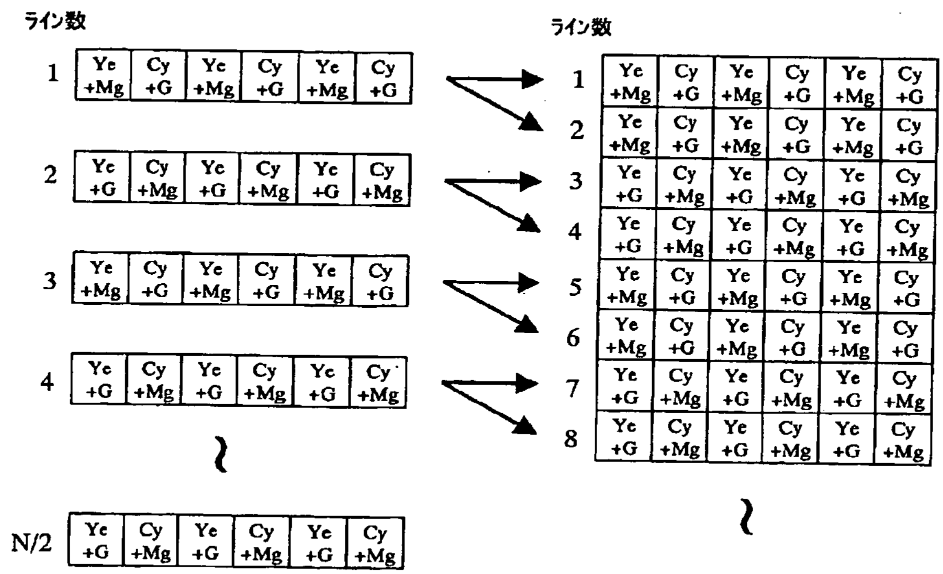
(b)同時化手段24に入力される信号

【図２９】



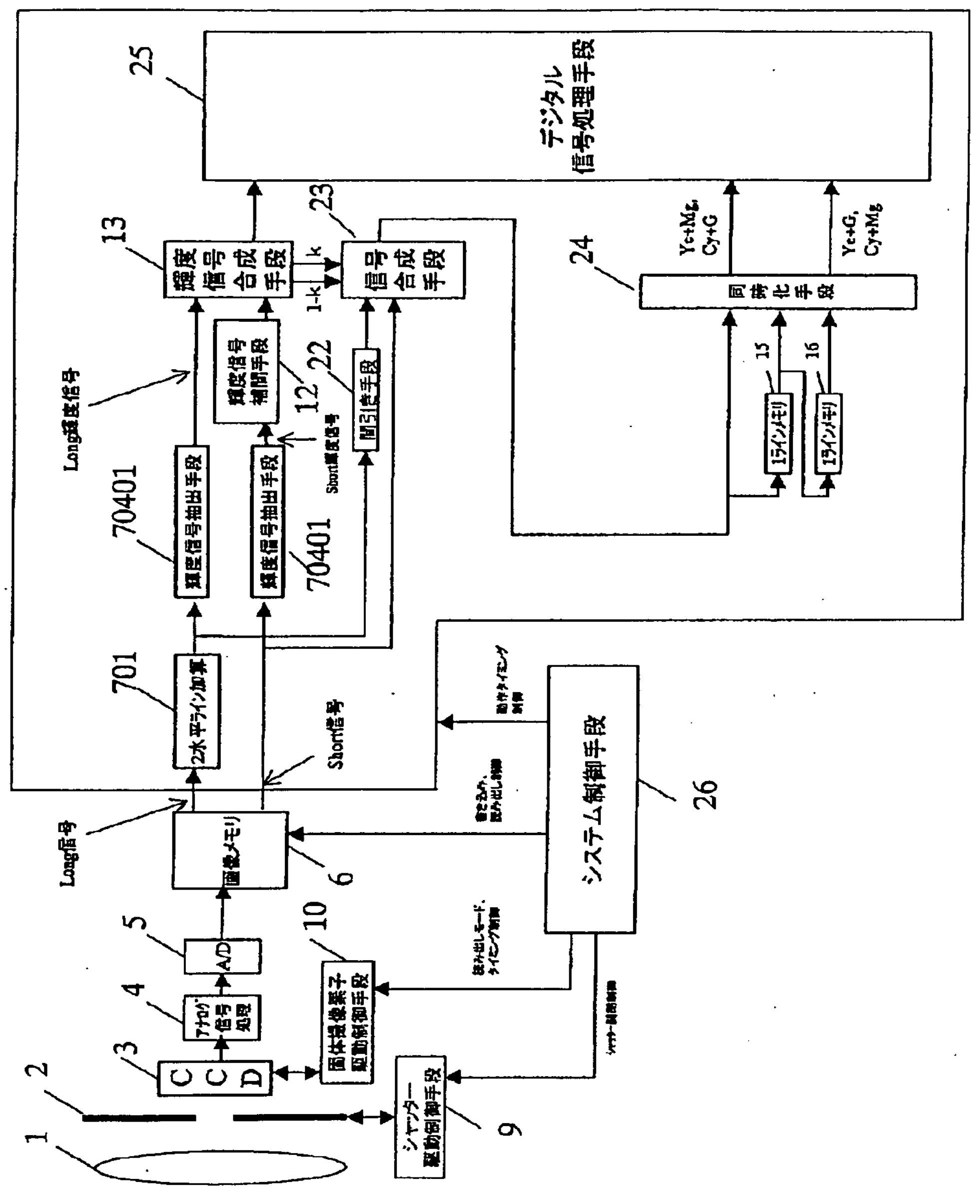
(a)合成信号　　(b)同時化手段19に入力される信号

【図３５】

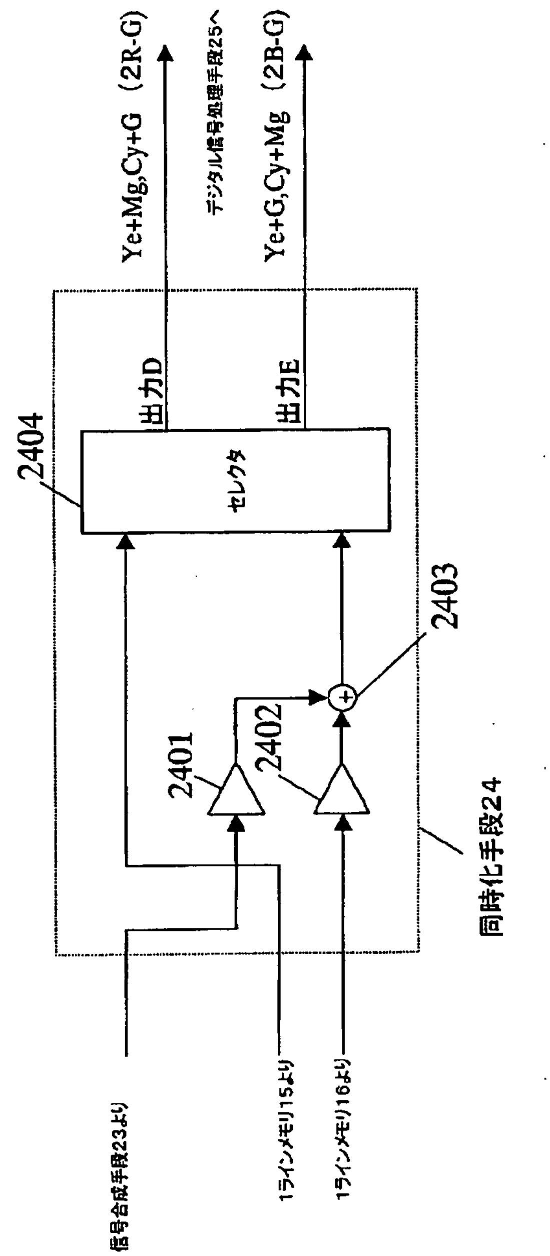


(a)補間処理前のshort信号　　(b)補間処理後のshort信号

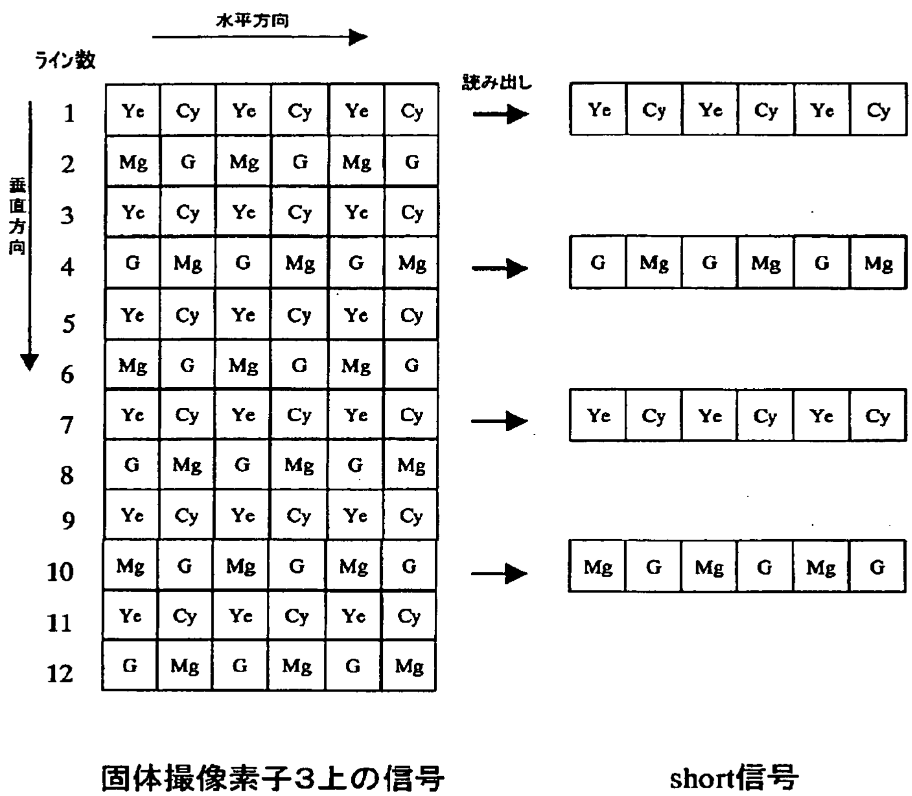
【図３０】


デジタル
信号処理手段
輝度信号合成手段
信号合成手段
同時化手段
輝度信号補間手段
間引き手段
1ラインメモリ
輝度信号抽出手段
2水平ライン加算
画像メモリ
A/D
アナログ信号処理
CCD
固体撮像素子駆動制御手段
シャッター駆動制御手段
システム制御手段
Long輝度信号
Short輝度信号
Short信号
Long信号
Ye+Mg,
Cy+G
Ye+G,
Cy+Mg
k
1-k
25
13
23
24
12
22
15
16
70401
701
26
6
5
4
3
2
1
10
9

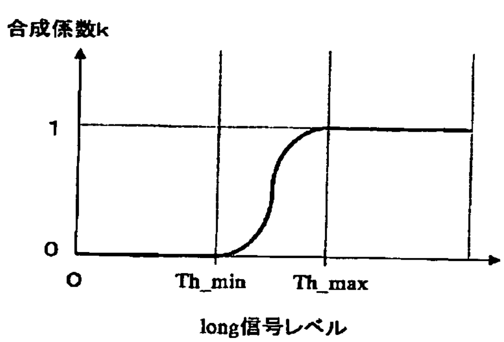
【図３１】


Ye+Mg,Cy+G（2R-G）
デジタル信号処理手段25へ
Ye+G,Cy+Mg（2B-G）
出力D
出力E
2404
セレクタ
2403
2401
2402
同時化手段24
信号合成手段23より
1ラインメモリ15より
1ラインメモリ16より

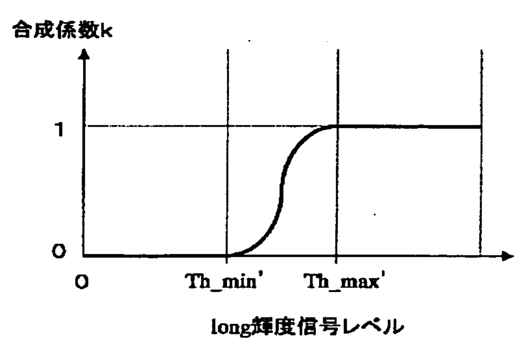
【図３３】


水平方向
ライン数
垂直方向
読み出し
1 Ye Cy Ye Cy Ye Cy
2 Mg G Mg G Mg G
3 Ye Cy Ye Cy Ye Cy
4 G Mg G Mg G Mg
5 Ye Cy Ye Cy Ye Cy
6 Mg G Mg G Mg G
7 Ye Cy Ye Cy Ye Cy
8 G Mg G Mg G Mg
9 Ye Cy Ye Cy Ye Cy
10 Mg G Mg G Mg G
11 Ye Cy Ye Cy Ye Cy
12 G Mg G Mg G Mg
Ye Cy Ye Cy Ye Cy
G Mg G Mg G Mg
Ye Cy Ye Cy Ye Cy
Mg G Mg G Mg G
固体撮像素子3上の信号
short信号

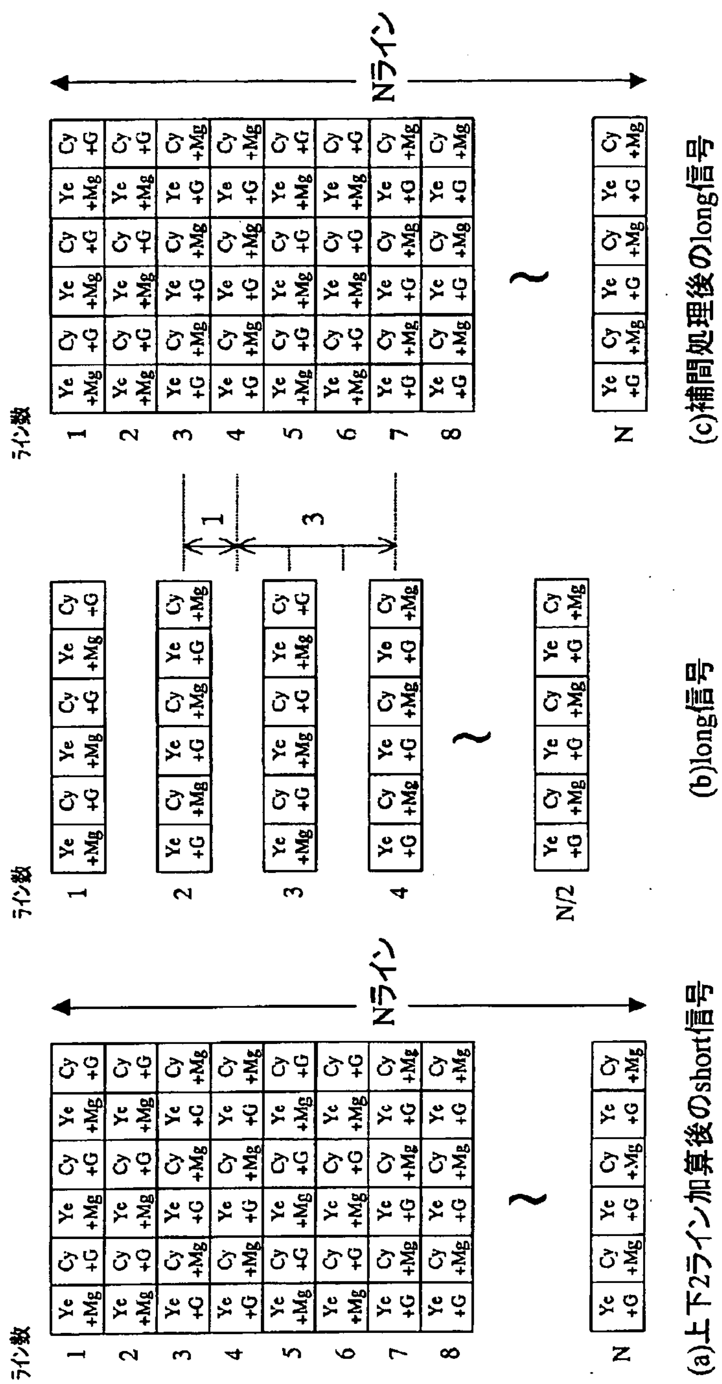
【図３７】


合成係数k
1
0
0
Th_min
Th_max
long信号レベル

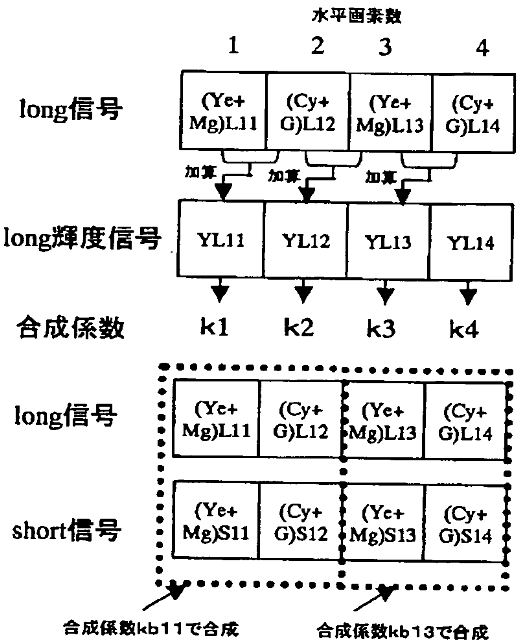
【図３９】


合成係数k
1
0
0
Th_min'
Th_max'
long輝度信号レベル

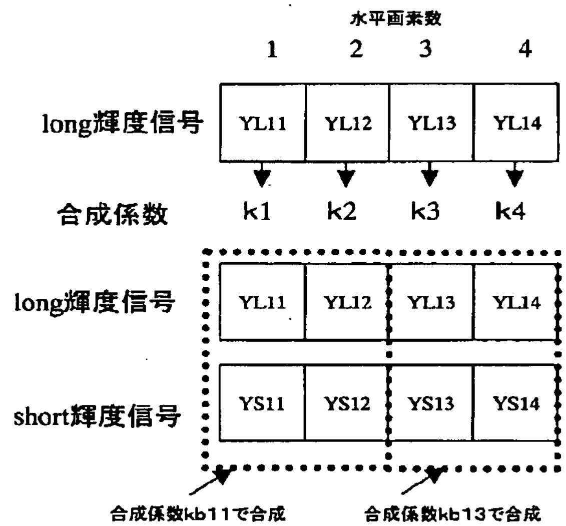
【図３４】



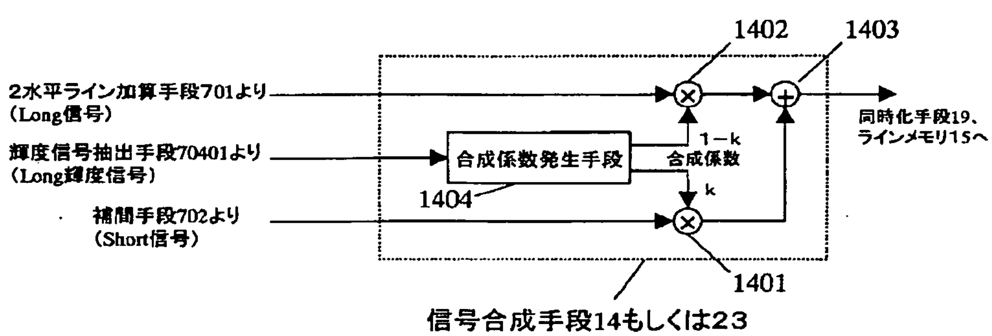
【図３８】


水平画素数
1 2 3 4
long信号
(Ye+Mg)L11 (Cy+G)L12 (Ye+Mg)L13 (Cy+G)L14
加算 加算 加算
long輝度信号
YL11 YL12 YL13 YL14
合成係数
k1 k2 k3 k4
long信号
(Ye+Mg)L11 (Cy+G)L12 (Ye+Mg)L13 (Cy+G)L14
short信号
(Ye+Mg)S11 (Cy+G)S12 (Ye+Mg)S13 (Cy+G)S14
合成係数kb11で合成
合成係数kb13で合成

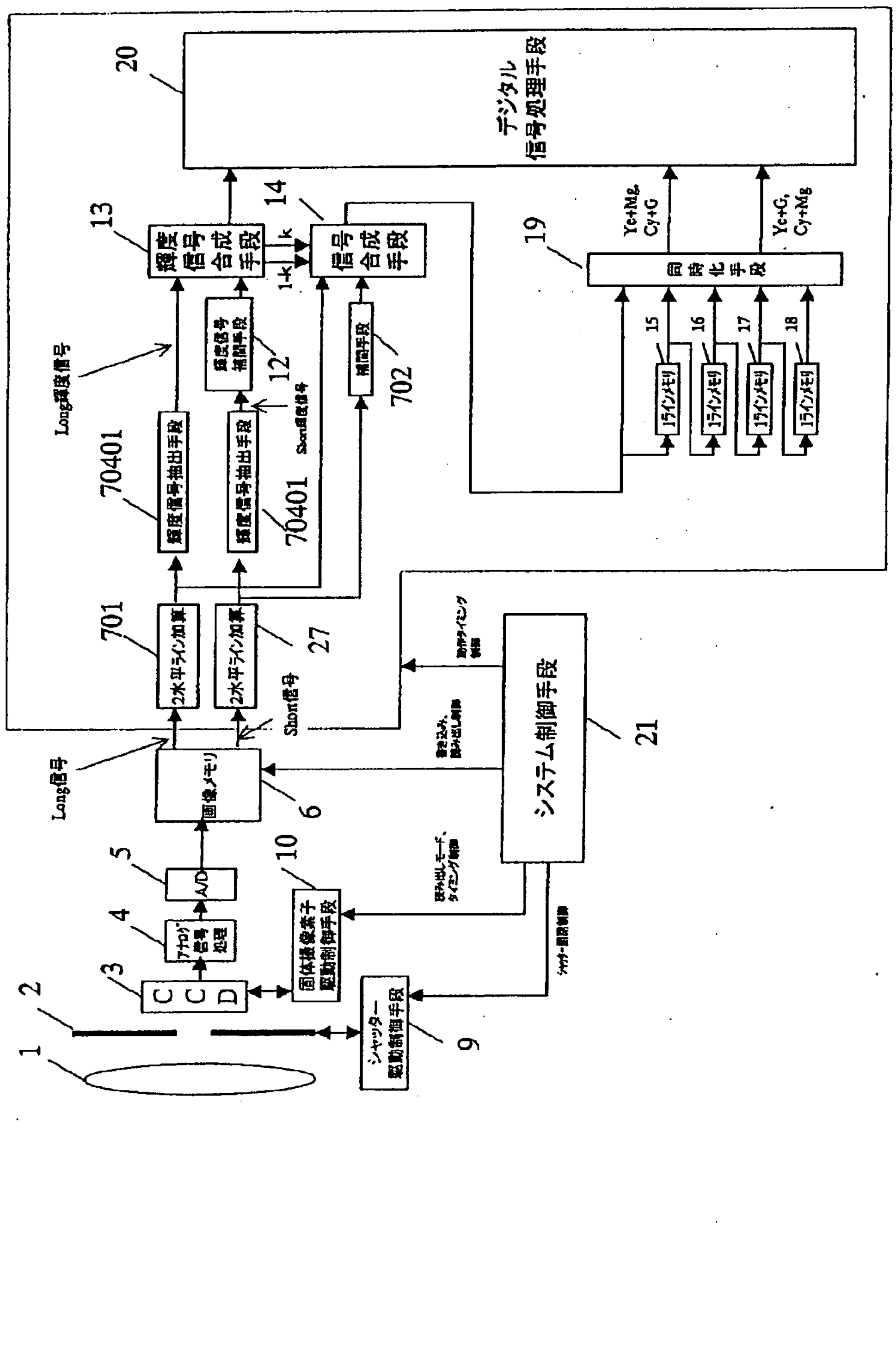
【図４３】


水平画素数
1 2 3 4
long輝度信号
YL11 YL12 YL13 YL14
合成係数
k1 k2 k3 k4
long輝度信号
YL11 YL12 YL13 YL14
short輝度信号
YS11 YS12 YS13 YS14
合成係数kb11で合成
合成係数kb13で合成

【図４２】

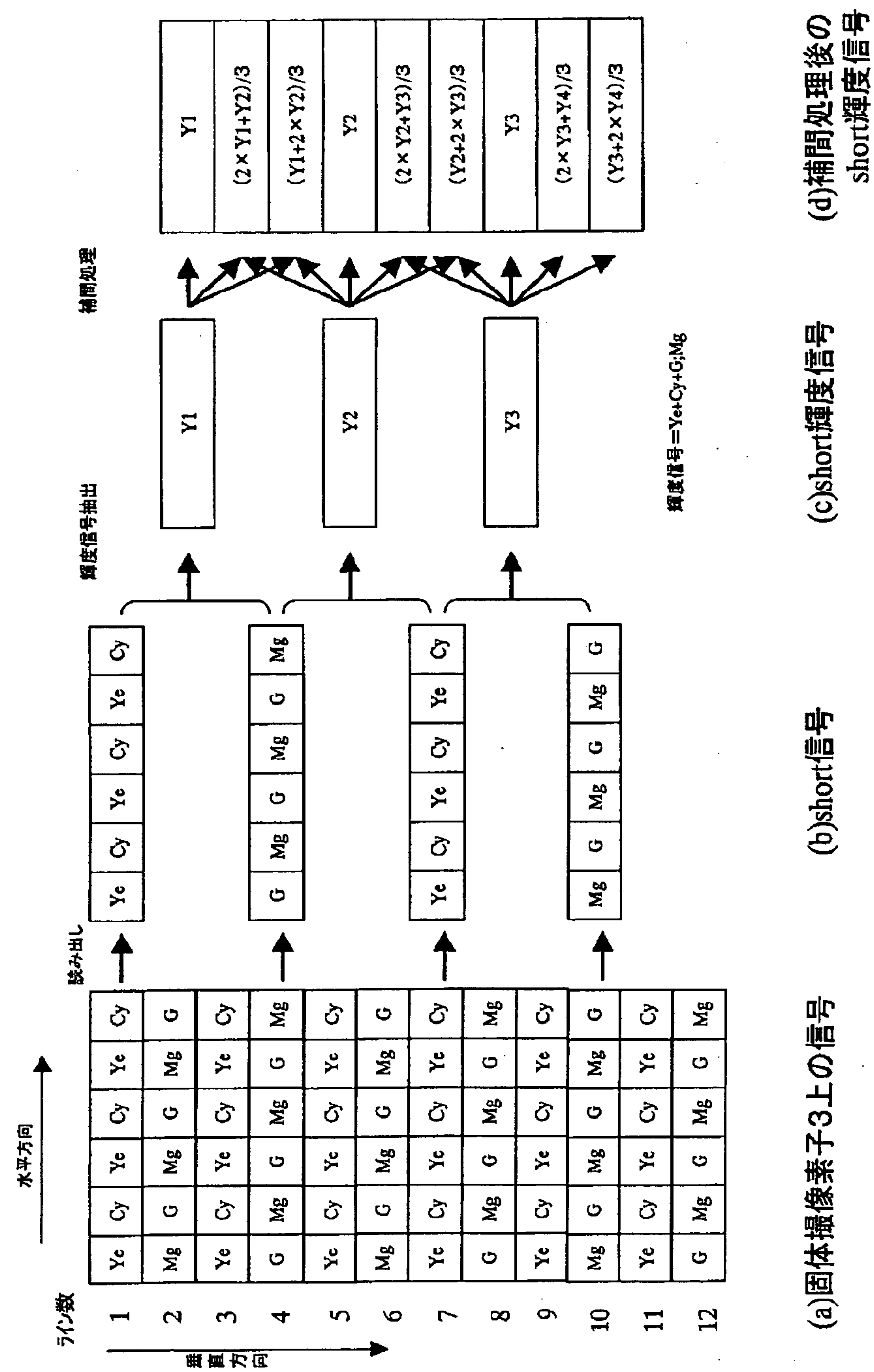

1402
1403
2水平ライン加算手段701より
(Long信号)
輝度信号抽出手段70401より
(Long輝度信号)
補間手段702より
(Short信号)
合成係数発生手段
1404
1−k
合成係数
k
同時化手段19、
ラインメモリ15へ
1401
信号合成手段14もしくは23

【図４０】

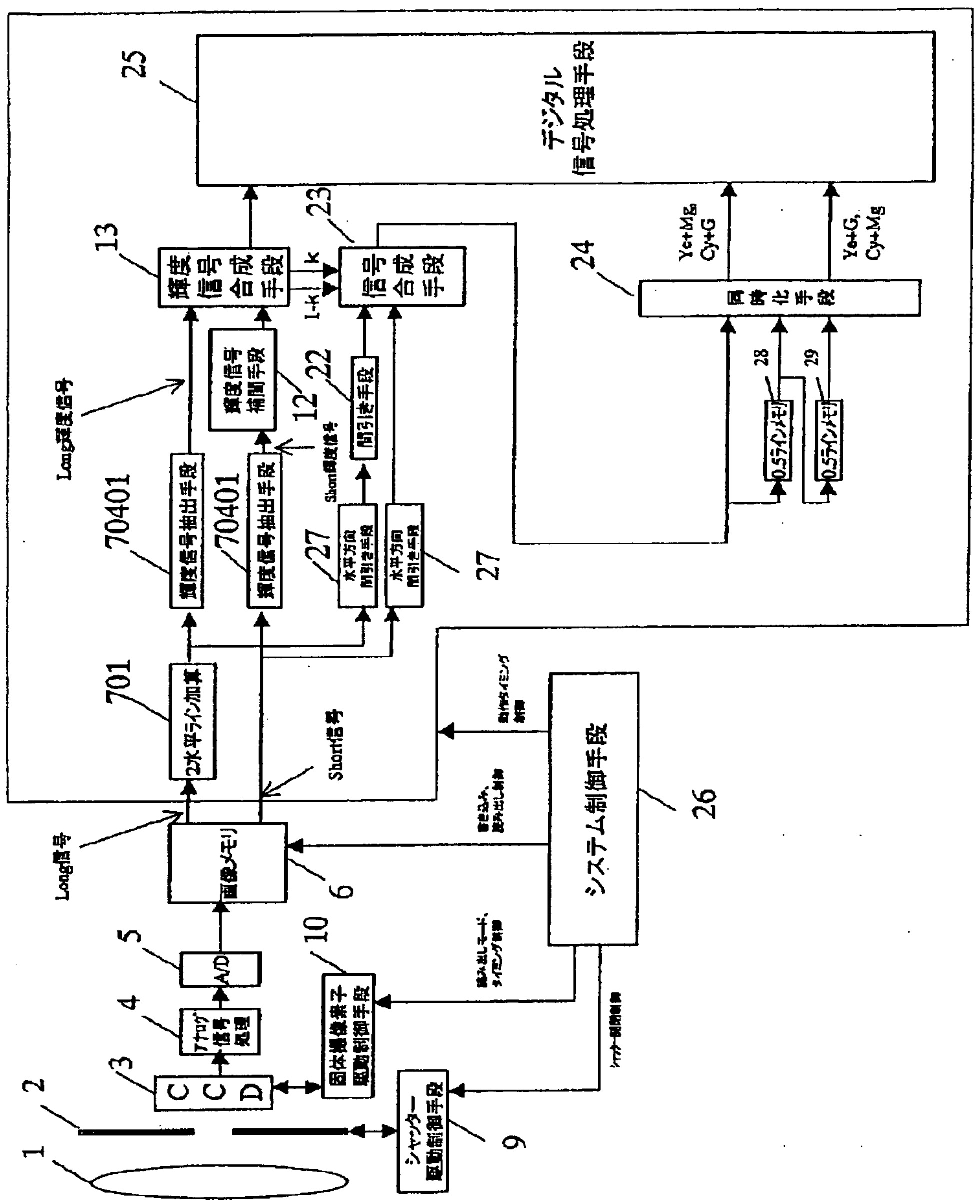


1
2
3
CCD
4
アナログ信号処理
5
A/D
6
画像メモリ
Long信号
Short信号
701
2水平ライン加算
27
2水平ライン加算
70401
輝度信号抽出手段
70401
輝度信号抽出手段
Long輝度信号
Short輝度信号
12
輝度信号補間手段
702
補間手段
13
輝度信号合成手段
k
1-k
14
信号合成手段
20
デジタル信号処理手段
15
16
17
18
1ラインメモリ
1ラインメモリ
1ラインメモリ
1ラインメモリ
19
同時化手段
Ye+Mg, Cy+G
Ye+G, Cy+Mg
9
シャッター駆動制御手段
10
固体撮像素子駆動制御手段
21
システム制御手段
シャッター開閉制御
読み出しモード、タイミング制御
書き込み、読み出し制御
動作タイミング制御

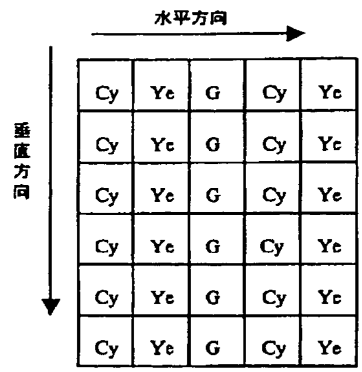
【図４１】


水平方向
ライン数
垂直方向
読み出し
輝度信号抽出
補間処理
輝度信号＝Ye+Cy+G+Mg
Y1
Y2
Y3
(2×Y1+Y2)/3
(Y1+2×Y2)/3
(2×Y2+Y3)/3
(Y2+2×Y3)/3
(2×Y3+Y4)/3
(Y3+2×Y4)/3
(a)固体撮像素子3上の信号
(b)short信号
(c)short輝度信号
(d)補間処理後のshort輝度信号

【図４４】


デジタル信号処理手段
25
輝度信号合成手段
13
信号合成手段
23
k
1-k
輝度信号補間手段
12
間引き手段
22
Long輝度信号
Short輝度信号
輝度信号抽出手段
70401
水平方向間引き手段
27
同時化手段
24
Ye+Mg, Cy+G
Ye+G, Cy+Mg
0.5ラインメモリ
28
29
2水平ライン加算
701
Short信号
Long信号
画像メモリ
6
システム制御手段
26
A/D
5
アナログ信号処理
4
CCD
3
固体撮像素子駆動制御手段
10
シャッター駆動制御手段
9
1
2

【図４６】



フロントページの続き

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5C065 AA03 BB48 CC01 CC08 CC09 DD07 DD17 EE05 EE07 GG13 GG15 GG21 GG30

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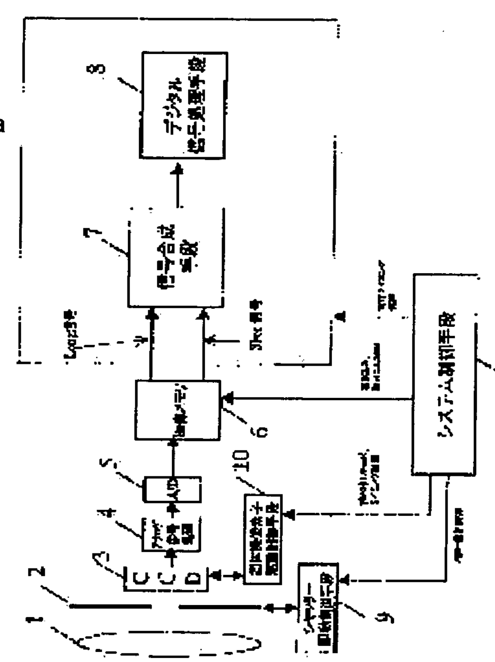
SAKAGAMI SHIGEO
TO TOMOAKI
NAKAYAMA MASAAKI

(54) SOLID-STATE IMAGE PICKUP DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To solve such a problem of a conventional dynamic range extension camera that the camera is too expensive because the camera requires a plurality of image pickup element and a full pixel read CCD.
SOLUTION: The solid-state image pickup device of this invention employs an inter-line CCD 3 (IT-CCD) that can read signals in two read modes of a filed read mode and a frame read mode. A system control means 11 controls the exposure of the CCD 3 and the signal read mode to acquire an image by the filed read mode for a short time exposure signal (short signal) and to acquire another image by the frame read mode for a long time exposure signal (long signal). The dynamic range is extended by synthesizing the images by a signal synthesis means 7.



LEGAL STATUS

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[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It is the solid state camera characterized by at least one being a picture signal with few pixels compared with other picture signals among the picture signals which have the solid state image sensor which outputs two or more picture signals with which light exposure differs, and a signal composition means to compound the picture signal outputted from said solid state image sensor, and are outputted from said solid state image sensor.
[Claim 2] The solid state camera according to claim 1 characterized by the picture signal with few pixels being a picture signal which had the pixel thinned out perpendicularly.
[Claim 3] The solid state image sensor which has a transfer means for outputting outside two or more photo diodes arranged in the shape of a matrix, and the charge accumulated on said photo diode, It has a protection-from-light means to shade the light which carries out incidence to said photo diode, and a signal composition means to compound the picture signal outputted from said solid state image sensor. Said solid state image sensor The charge accumulated on said photo diode as the 1st exposure is outputted through said transfer means after impression of the 1st read-out control pulse. Furthermore, the charge accumulated on said photo diode in the 2nd exposure completed with the exposure termination by said protection-from-light means is outputted through said transfer means after said 1st read-out control pulse impression after impression of the 2nd read-out control pulse. Said picture signal composition means is a solid state camera characterized by compounding the picture signal photoed by said 1st exposure and said 2nd exposure.
[Claim 4] The solid state image sensor which has a transfer means for outputting outside two or more photo diodes arranged in the shape of a matrix, and the charge accumulated on said photo diode, It has a protection-from-light means to shade the light which carries out incidence to said photo diode, and a signal composition means to compound the picture signal outputted from said solid state image sensor. Said solid state image sensor Some charges accumulated on said photo diode as the 1st exposure are outputted through said transfer means after impression of the 1st read-out control pulse. Furthermore, the charge accumulated on said photo diode in the 2nd exposure completed with the exposure termination by said protection-from-light means is outputted through said transfer means after said 1st read-out control pulse impression after impression of the 2nd read-out control pulse. Said picture signal composition means is a solid state camera characterized by compounding the picture signal photoed by said 1st exposure and said 2nd exposure.
[Claim 5] The solid state image sensor which has a transfer means for outputting outside two or more photo diodes arranged in the shape of a matrix, and the charge accumulated on said photo diode, It has a protection-from-light means to shade the light which carries out incidence to said photo diode, and a signal composition means to compound the picture signal outputted from said solid state image sensor. Said solid state image sensor The charge accumulated on said photo diode as the 1st exposure is outputted through said transfer means by field read-out after impression of the 1st read-out control pulse. Furthermore, the charge accumulated on said photo diode in the 2nd exposure completed with the exposure termination by said protection-from-light means is outputted through said transfer means after said 1st read-out control pulse impression after impression of the 2nd read-out control

pulse. Said picture signal composition means is a solid state camera characterized by compounding the picture signal photoed by said 1st exposure and said 2nd exposure.
[Claim 6] The exposure time of the 1st exposure is a solid state camera given in either of claim 3 to claims 5 characterized by controlling by the electronic shutter.
[Claim 7] The charge accumulated in photo diode in the 2nd exposure after impression of the 2nd read-out control pulse is a solid state camera given in either of claim 3 to claims 6 characterized by being outputted by frame read-out.
[Claim 8] The image read after impression of the 1st read-out control pulse is a solid state camera given in either of claim 3 to claims 7 characterized by being an image with few pixels compared with the image read after the 2nd read-out control pulse impression.
[Claim 9] A mechanical protection-from-light means is a solid state camera given in either of claim 3 to claims 8 characterized by making an optical diaphragm serve a double purpose.
[Claim 10] The solid state image sensor which outputs two picture signals with which light exposure differs from the number of pixels, A interpolation means to change into the same signal format as a picture signal with many pixels a picture signal with few pixels between two picture signals with which said numbers of pixels differ by interpolation processing, A picture signal with few said pixels, or the picture signal changed into the same signal format as a picture signal with many pixels by said interpolation means, Or at least one of the picture signals with many said pixels is made into a synthetic control signal. The solid state camera characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with many pixels by said interpolation means, and a picture signal with many said pixels, according to this synthetic control signal.
[Claim 11] The solid state image sensor which outputs two picture signals with which light exposure differs from the number of pixels, A luminance-signal extract means to extract the luminance signal from a picture signal with few pixels between two picture signals with which said numbers of pixels differ, or a picture signal with many said pixels, A interpolation means to change a picture signal with few said pixels into the same signal format as a picture signal with many pixels by interpolation processing, At least one of the luminance signals extracted from the luminance signal extracted from the picture signal with few said pixels or the picture signal with many said pixels is made into a synthetic control signal. The solid state camera characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with many pixels by said interpolation means, and a picture signal with many said pixels, according to this synthetic control signal.
[Claim 12] A signal composition means is a solid state camera according to claim 10 or 11 characterized by to have the synthetic means which carries out weighting addition of the picture signal changed into the same signal format as a picture signal with many pixels by the interpolation means, and the picture signal with many pixels according to the multiplier k generated by multiplier generating means generate a certain multiplier k according to the signal level of a synthetic control signal, and said multiplier generating means.
[Claim 13] The solid state image sensor which outputs two picture signals with which light exposure differs from the number of pixels, A luminance-signal extract means to extract the luminance signal from a picture signal with few pixels between two picture signals with which said numbers of pixels differ, and a picture signal with many said pixels, The 1st interpolation means which changes the luminance signal extracted from the picture signal with few said pixels into the same signal format as the luminance signal acquired from a picture signal with many pixels by interpolation processing, The luminance signal with which said pixel was extracted from few picture signals, or the luminance signal acquired from a picture signal with many pixels by said 1st interpolation means and the luminance signal changed into the same signal format, Or at least one of the luminance signals extracted from the picture signal with many said pixels is made into a synthetic control signal. According to this synthetic control signal, a luminance-signal composition means to compound the luminance signal acquired from a picture signal with many pixels by said 1st interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many said pixels, and a picture signal with few said pixels The 2nd interpolation means

changed into the same signal format as a picture signal with many pixels by interpolation processing, The solid state camera characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with many pixels by said 2nd interpolation means, and a picture signal with many said pixels according to said synthetic control signal.

[Claim 14] 1st multiplier generating means by which a luminance-signal composition means generates a certain multiplier k according to the signal level of a synthetic control signal, The 1st synthetic means which carries out weighting addition of the luminance signal acquired from a picture signal with many pixels by the 1st interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many pixels according to the multiplier k generated by said 1st multiplier generating means, The solid state camera according to claim 13 characterized by ****(ing).

[Claim 15] A signal composition means is a solid state camera according to claim 13 or 14 characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal changed into the same signal format as a picture signal with many pixels by the 2nd interpolation means according to at least one multiplier k among the multipliers k generated by the 1st multiplier generating means, and the picture signal with many pixels.

[Claim 16] The inside of the multiplier k by which the signal composition means was generated by the 1st multiplier generating means, Even if there are few the average of two or more multipliers k, maximums, minimum values, and mean values, it responds to any one. The solid state camera according to claim 13 or 14 characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal changed into the same signal format as a picture signal with many pixels by the 2nd interpolation means, and the picture signal with many pixels.

[Claim 17] 2nd multiplier generating means by which a signal composition means generates a certain multiplier k according to the signal level of a synthetic control signal, It responds to the multiplier k generated by said 2nd multiplier generating means. The solid state camera according to claim 13 or 14 characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal changed into the same signal format as a picture signal with many pixels by the 2nd interpolation means, and the picture signal with many pixels.

[Claim 18] The solid state image sensor which outputs two picture signals with which light exposure differs from the number of pixels, A luminance-signal extract means to extract the luminance signal from a picture signal with few said pixels between two picture signals with which said numbers of pixels differ, and a picture signal with many said pixels, A interpolation means to change the luminance signal extracted from the picture signal with few said pixels into the same signal format as the luminance signal acquired from a picture signal with many pixels by interpolation processing, The luminance signal extracted from the picture signal with few said pixels, or the luminance signal acquired from a picture signal with many pixels by said interpolation means and the luminance signal changed into the same signal format, Or at least one of the luminance signals extracted from the picture signal with many said pixels is made into a synthetic control signal. A luminance-signal composition means to compound the luminance signal acquired from a picture signal with many pixels by said interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many said pixels according to this synthetic control signal, An infanticide means to change a picture signal with many said pixels into the same signal format as a picture signal with few pixels by infanticide processing, The solid state camera characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with few pixels by said infanticide means, and a picture signal with few said pixels according to said synthetic control signal.

[Claim 19] 1st multiplier generating means by which a luminance-signal composition means generates a certain multiplier k according to the signal level of a synthetic control signal, The 1st synthetic means which carries out weighting addition of the luminance signal acquired from a picture signal with many pixels by the interpolation means, the luminance signal

changed into the same signal format, and the luminance signal extracted from the picture signal with many pixels according to the multiplier k generated by said 1st multiplier generating means, The solid state camera according to claim 18 characterized by ****(ing).
[Claim 20] A signal composition means is a solid state camera according to claim 18 or 19 characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal changed into the same signal format as a picture signal with few pixels by the infanticide means according to at least one multiplier k among the multipliers k generated by the 1st multiplier generating means, and the picture signal with few pixels.
[Claim 21] The inside of the multiplier k by which the signal composition means was generated by the 1st multiplier generating means, Even if there are few the average of two or more multipliers k, maximums, minimum values, and mean values, it responds to any one. The solid state camera according to claim 18 or 19 characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal changed into the same signal format as a picture signal with few pixels by the infanticide means, and the picture signal with few pixels.
[Claim 22] A signal composition means is the solid state camera according to claim 18 or 19 characterized by to have the 2nd synthetic means which carries out weighting addition of the picture signal changed into the same signal format as a picture signal with few pixels by the infanticide means, and the picture signal with few pixels according to the multiplier k generated by 2nd multiplier generating means generate a certain multiplier k according to the signal level of a synthetic control signal, and said 2nd multiplier generating means.
[Claim 23] The solid state image sensor which outputs two picture signals with which light exposure differs from the number of pixels, A luminance-signal extract means to extract the luminance signal from a picture signal with few said pixels between two picture signals with which said numbers of pixels differ, and a picture signal with many said pixels, A interpolation means to change the luminance signal extracted from the picture signal with few said pixels into the same signal format as the luminance signal acquired from a picture signal with many pixels by interpolation processing, The luminance signal extracted from the picture signal with few said pixels, or the luminance signal acquired from a picture signal with many pixels by said interpolation means and the luminance signal changed into the same signal format, Or at least one of the luminance signals extracted from the picture signal with many said pixels is made into a synthetic control signal. A luminance-signal composition means to compound the luminance signal acquired from a picture signal with many pixels by said interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many said pixels according to this synthetic control signal, The 1st infanticide means which thins out a pixel by infanticide processing to a picture signal with many said pixels, The solid state camera characterized by having the 2nd infanticide means which thins out a pixel by infanticide processing to a picture signal with few said pixels, and a signal composition means to compound the picture signal which had the pixel thinned out by said 1st infanticide means and the 2nd infanticide means according to said synthetic control signal.
[Claim 24] 1st multiplier generating means by which a luminance-signal composition means generates a certain multiplier k according to the signal level of a synthetic control signal, The 1st synthetic means which carries out weighting addition of the luminance signal acquired from a picture signal with many pixels by the interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many pixels according to the multiplier k generated by said 1st multiplier generating means, The solid state camera according to claim 23 characterized by ****(ing).
[Claim 25] A signal composition means is a solid state camera according to claim 23 or 24 characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal which had the pixel thinned out by the 1st infanticide means and the 2nd infanticide means according to at least one multiplier k among the multipliers k generated by the 1st multiplier generating means.
[Claim 26] A signal composition means is a solid state camera according to claim 23 or 24

characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal of the average of two or more multipliers k, maximum, the minimum value, and a mean value which had the pixel thinned out by the 1st infanticide means and the 2nd infanticide means according to any one at least among the multipliers k generated by the 1st multiplier generating means.
[Claim 27] A signal composition means is a solid state camera according to claim 23 or 24 characterized by having the 2nd synthetic means which carries out weighting addition of the picture signal which had the pixel thinned out by the 1st infanticide means and the 2nd infanticide means according to the multiplier k generated by 2nd multiplier generating means to generate a certain multiplier k according to the signal level of a synthetic control signal, and said 2nd multiplier generating means.
[Claim 28] A solid state camera given in either of claims 1, 2, 3, 5, 10, 11, 13, 18, and 23 characterized by for the picture signal with few pixels being a picture signal of the 1 field, and the picture signal with many pixels being a picture signal of one frame.
[Claim 29] A multiplier generating means, the 1st multiplier generating means, and the 2nd multiplier generating means are a solid state camera given in either of claim 10 to claims 27 characterized by generating a multiplier k according to the signal level of at least 1 pixel of a synthetic control signal.
[Claim 30] A multiplier generating means, the 1st multiplier generating means, and the 2nd multiplier generating means are a solid state camera given in either of claim 10 to claims 27 characterized by the thing of the average with a signal level [of a synthetic control signal] of two or more pixels, maximum, the minimum value, and a mean value for which a multiplier k is generated according to any one at least.
[Claim 31] A multiplier generating means, the 1st multiplier generating means, and the 2nd multiplier generating means are a solid state camera given in either of claim 10 to claims 27 characterized by generating the multiplier k which corresponds for every pixel of a synthetic control signal.
[Claim 32] A multiplier generating means, the 1st multiplier generating means, and the 2nd multiplier generating means are a solid state camera given in either of claim 10 to claims 27 characterized by generating the multiplier k corresponding to the block which consists of two or more pixels of a synthetic control signal.
[Claim 33] A multiplier generating means, the 1st multiplier generating means, and the 2nd multiplier generating means are a solid state camera given in either of claim 10 to claims 27 characterized by the thing of the average of each signal level within the block which consists of two or more pixels of a synthetic control signal, maximum, the minimum value, and a mean value for which a certain multiplier k is generated according to any one at least.
[Claim 34] A multiplier generating means, the 1st multiplier generating means, and the 2nd multiplier generating means are a solid state camera given in either of claim 10 to claims 27 characterized by generating a certain multiplier k according to the signal level of the pixel which exists in the specific location within a block among each signal level within the block which consists of two or more pixels of a synthetic control signal.
[Claim 35] It is a solid state camera given in either of claim 1 to claims 34 which the picture signal with few pixels between two picture signals with which light exposure differs from the number of pixels is a short-time exposure signal, and are characterized by the picture signal with many pixels being a long duration exposure signal.
[Claim 36] It is a solid state camera given in either of claim 1 to claims 34 which the picture signal with few pixels between two picture signals with which light exposure differs from the number of pixels is a long duration exposure signal, and are characterized by the picture signal with many pixels being a short-time exposure signal.
[Claim 37] The light exposure of the picture signal picturized with a solid state image sensor is a solid state camera given in either of claim 1 to claims 36 characterized by controlling by the electronic shutter function of a mechanical protection-from-light means or a solid state image sensor.
[Claim 38] The color filter formed on a solid state image sensor is a solid state camera given

in either of claim 1 to claims 37 characterized by being four colors of a Magenta, Green, yellow, and cyanogen.
[Claim 39] The color filter array formed on a solid state image sensor is a solid state camera given in either of claim 1 to claims 38 characterized by being the complementary color check type which consists of four colors of a Magenta, Green, yellow, and cyanogen.
[Claim 40] The color filter formed on a solid state image sensor is a solid state camera given in either of claim 1 to claims 37 characterized by being red, Green, and three blue colors.
[Claim 41] The color filter array formed on a solid state image sensor is a solid state camera given in either of claim 1 to claims 37 characterized by being 3 color stripe type which consists of red, Green, and three blue colors.
[Claim 42] A solid state image sensor is a solid state camera given in either of claim 1 to claims 41 characterized by being the INTARAIN transfer CCD (IT-CCD).

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the solid state camera in which dynamic range expansion of a photography image is possible.
[0002]
[Description of the Prior Art] As a solid state camera for compounding two picture signals with which light exposure differs, and acquiring the large video signal of a dynamic range from the former, there are some which are indicated by JP,9-214829,A and JP,9-275527,A, for example.
[0003] In JP,9-214829,A, after carrying out the level shift of the continuous field image of two sheets which changed and photoed the exposure time, respectively, the digital still camera which can obtain the large image of a dynamic range by compounding in the image of one frame is indicated.
[0004] Moreover, in JP,9-275527,A, after carrying out the level shift of two or more frame images with which the exposure times acquired from two or more CCD differed, respectively, the digital still camera which can obtain the large image of a dynamic range by compounding in the image of one frame is indicated.
[0005] The example of the video camera which otherwise expanded the dynamic range using special CCD which can read a long duration exposure signal and a short-time exposure signal within 1 field period is known (image media society technical report Vol.22, No.3, development [of a pp1-6(1998)" veneer Hyper-D color camera signal-processing method]").
[0006]
[Problem(s) to be Solved by the Invention] However, in the digital still camera currently indicated, for example in JP,9-214829,A, in order to compound the continuous field image of two sheets which changed and photoed the exposure time, the image resolution for the 1 field, i.e., the resolution of the one half of the number of pixels of CCD, is obtained, but, as for the image after composition, we are anxious about the lack of resolution of a photography image.
[0007] On the other hand, in the digital still camera currently indicated in JP,9-275527,A, in order to compound the picture signal with which the exposure times photoed by two or more CCD differ, two or more CCD is needed and the image after composition becomes disadvantageous in respect of the size of image pick-up equipment, and cost, although the image resolution for one frame, i.e., the resolution for several pixel minutes of CCD, is obtained.
[0008] Moreover, in the case of image pick-up equipment [finishing / that image media society technical report Vol.22 No.3, and development" of a pp1-6(1998)" veneer Hyper-D color camera signal-processing method report], special CCD is needed for dynamic range expansion of a photography image. This invention is made in view of the above problem, and it is cheap by using one solid state image sensor generally used to a noncommercial solid state camera, and aims at offering the solid state camera which can photo the image to which the dynamic range was expanded in the image resolution of the number average of pixels of CCD.
[0009]
[Means for Solving the Problem] In order to solve such a technical problem, invention of this application according to claim 1 has the solid state image sensor which outputs two or more

picture signals with which light exposure differs, and a signal composition means to compound the picture signal outputted from said solid state image sensor, and at least one of the picture signals outputted from said solid state image sensor is characterized by being a picture signal with few pixels compared with other picture signals.
[0010] Two or more photo diodes with which invention of this application according to claim 3 has been arranged in the shape of a matrix, The solid state image sensor which has a transfer means for outputting outside the charge accumulated on said photo diode, It has a protection-from-light means to shade the light which carries out incidence to said photo diode, and a signal composition means to compound the picture signal outputted from said solid state image sensor. Said solid state image sensor The charge accumulated on said photo diode as the 1st exposure is outputted through said transfer means after impression of the 1st read-out control pulse. Furthermore, the charge accumulated on said photo diode in the 2nd exposure completed with the exposure termination by said protection-from-light means is outputted through said transfer means after said 1st read-out control pulse impression after impression of the 2nd read-out control pulse. Said picture signal composition means is characterized by compounding the picture signal photoed by said 1st exposure and said 2nd exposure.
[0011] Two or more photo diodes with which invention of this application according to claim 4 has been arranged in the shape of a matrix, The solid state image sensor which has a transfer means for outputting outside the charge accumulated on said photo diode, It has a protection-from-light means to shade the light which carries out incidence to said photo diode, and a signal composition means to compound the picture signal outputted from said solid state image sensor. Said solid state image sensor Some charges accumulated on said photo diode as the 1st exposure are outputted through said transfer means after impression of the 1st read-out control pulse. Furthermore, the charge accumulated on said photo diode in the 2nd exposure completed with the exposure termination by said protection-from-light means is outputted through said transfer means after said 1st read-out control pulse impression after impression of the 2nd read-out control pulse. Said picture signal composition means is characterized by compounding the picture signal photoed by said 1st exposure and said 2nd exposure.
[0012] Two or more photo diodes with which invention of this application according to claim 5 has been arranged in the shape of a matrix, The solid state image sensor which has a transfer means for outputting outside the charge accumulated on said photo diode, It has a protection-from-light means to shade the light which carries out incidence to said photo diode, and a signal composition means to compound the picture signal outputted from said solid state image sensor. Said solid state image sensor The charge accumulated on said photo diode as the 1st exposure is outputted through said transfer means by field read-out after impression of the 1st read-out control pulse. Furthermore, the charge accumulated on said photo diode in the 2nd exposure completed with the exposure termination by said protection-from-light means is outputted through said transfer means after said 1st read-out control pulse impression after impression of the 2nd read-out control pulse. Said picture signal composition means is characterized by compounding the picture signal photoed by said 1st exposure and said 2nd exposure.
[0013] The solid state image sensor with which invention of this application according to claim 10 outputs two picture signals with which light exposure differs from the number of pixels, A interpolation means to change into the same signal format as a picture signal with many pixels a picture signal with few pixels between two picture signals with which said numbers of pixels differ by interpolation processing, A picture signal with few said pixels, or the picture signal changed into the same signal format as a picture signal with many pixels by said interpolation means, Or at least one of the picture signals with many said pixels is made into a synthetic control signal. It is characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with many pixels by said interpolation means, and a picture signal with many said pixels, according to this synthetic control signal.

[0014] The solid state image sensor with which invention of this application according to claim 11 outputs two picture signals with which light exposure differs from the number of pixels, A luminance-signal extract means to extract the luminance signal from a picture signal with few pixels between two picture signals with which said numbers of pixels differ, or a picture signal with many said pixels, A interpolation means to change a picture signal with few said pixels into the same signal format as a picture signal with many pixels by interpolation processing, At least one of the luminance signals extracted from the luminance signal extracted from the picture signal with few said pixels or the picture signal with many said pixels is made into a synthetic control signal. It is characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with many pixels by said interpolation means, and a picture signal with many said pixels, according to this synthetic control signal.

[0015] The solid state image sensor with which invention of this application according to claim 13 outputs two picture signals with which light exposure differs from the number of pixels, A luminance-signal extract means to extract the luminance signal from a picture signal with few pixels between two picture signals with which said numbers of pixels differ, and a picture signal with many said pixels, The 1st interpolation means which changes the luminance signal extracted from the picture signal with few said pixels into the same signal format as the luminance signal acquired from a picture signal with many pixels by interpolation processing, The luminance signal with which said pixel was extracted from few picture signals, or the luminance signal acquired from a picture signal with many pixels by said 1st interpolation means and the luminance signal changed into the same signal format, Or at least one of the luminance signals extracted from the picture signal with many said pixels is made into a synthetic control signal. According to this synthetic control signal, a luminance-signal composition means to compound the luminance signal acquired from a picture signal with many pixels by said 1st interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many said pixels, and a picture signal with few said pixels The 2nd interpolation means changed into the same signal format as a picture signal with many pixels by interpolation processing, It is characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with many pixels by said 2nd interpolation means, and a picture signal with many said pixels according to said synthetic control signal.

[0016] The solid state image sensor with which invention of this application according to claim 18 outputs two picture signals with which light exposure differs from the number of pixels, A luminance-signal extract means to extract the luminance signal from a picture signal with few said pixels between two picture signals with which said numbers of pixels differ, and a picture signal with many said pixels, A interpolation means to change the luminance signal extracted from the picture signal with few said pixels into the same signal format as the luminance signal acquired from a picture signal with many pixels by interpolation processing, The luminance signal extracted from the picture signal with few said pixels, or the luminance signal acquired from a picture signal with many pixels by said interpolation means and the luminance signal changed into the same signal format, Or at least one of the luminance signals extracted from the picture signal with many said pixels is made into a synthetic control signal. A luminance-signal composition means to compound the luminance signal acquired from a picture signal with many pixels by said interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many said pixels according to this synthetic control signal, An infanticide means to change a picture signal with many said pixels into the same signal format as a picture signal with few pixels by infanticide processing, It is characterized by having a signal composition means to compound the picture signal changed into the same signal format as a picture signal with few pixels by said infanticide means, and a picture signal with few said pixels according to said synthetic control signal.

[0017] The solid state image sensor with which invention of this application according to claim 23 outputs two picture signals with which light exposure differs from the number of pixels, A

luminance-signal extract means to extract the luminance signal from a picture signal with few said pixels between two picture signals with which said numbers of pixels differ, and a picture signal with many said pixels, A interpolation means to change the luminance signal extracted from the picture signal with few said pixels into the same signal format as the luminance signal acquired from a picture signal with many pixels by interpolation processing, The luminance signal extracted from the picture signal with few said pixels, or the luminance signal acquired from a picture signal with many pixels by said interpolation means and the luminance signal changed into the same signal format, Or at least one of the luminance signals extracted from the picture signal with many said pixels is made into a synthetic control signal. A luminance-signal composition means to compound the luminance signal acquired from a picture signal with many pixels by said interpolation means, the luminance signal changed into the same signal format, and the luminance signal extracted from the picture signal with many said pixels according to this synthetic control signal, The 1st infanticide means which thins out a pixel by infanticide processing to a picture signal with many said pixels, It is characterized by having the 2nd infanticide means which thins out a pixel by infanticide processing to a picture signal with few said pixels, and a signal composition means to compound the picture signal which had the pixel thinned out by said 1st infanticide means and the 2nd infanticide means according to said synthetic control signal.

[0018]

[Embodiment of the Invention] (Gestalt 1 of operation) Drawing 1 is the block diagram of the solid state camera in the gestalt 1 of operation of this invention. In this drawing, 1 presupposes that an optical lens and 2 are the INTARAIN transfers CCD (IT-CCD) for which an optical diaphragm, the machine shutter of combination, and 3 are solid state image sensors, and are generally used with the noncommercial solid state camera in the gestalt 1 of this operation. It is the image memory which memorizes the picture signal from which an analog signal processing means by which 4 consists of a correlation duplex sampling circuit and an automatic-gain-control (AGC) circuit, and 5 were changed into the A/D-conversion means by the A/D-conversion means 5, and 6 was changed into the digital signal. 7 is a signal composition means to compound two picture signals read from an image memory 6.

[0019] In the digital-signal-processing means 8, as for the signal acquired with the signal composition means 7, processing of encoding to separation of a luminance signal and a chrominance signal, noise rejection, edge enhancement, a matrix operation, and a specific format etc. is performed. Moreover, the machine shutter drive control means 9 is a means which controls closing motion of the machine shutter 2, and the solid state image sensor drive control means 10 is a means to control the mode of exposure control of a solid state image sensor 3 or signal read-out, timing, etc. In addition, the modes of operation and the timing of operation of a component of all above including these shall be controlled by the system control means 11 integrative.

[0020] Drawing 2 (a), (b), (c), and (d) are the mimetic diagrams for explaining actuation of a solid state image sensor 3, and a configuration. in addition, in the gestalt 1 of operation of this invention, a solid state image sensor 3 is the INTARAIN transfer CCD (IT-CCD) which can read a signal in two read-out modes, field read-out mode and frame read-out mode, and is [4 pixels of perpendiculars like drawing 2 of explanation] level for convenience -- the so-called configuration which is 4x2 pixels which is 2 pixels explains.

[0021] Drawing 2 (a) and (b) are drawings for explaining the field read-out mode in IT-CCD. In drawing 2 (a), photo diode is a part in which the signal charge according to the intensity of light is accumulated by photo electric conversion, and this accumulated charge moves to the perpendicular transfer CCD by the control pulse impressed after fixed time amount. It is mixed on the perpendicular transfer CCD and the charge of the photo diode of two upper and lower sides which adjoin at this time is outputted outside through the level transfer CCD. The above is read-out actuation of the 1st field.

[0022] The 2nd field is compared when the pair of the photo diode mixed on the perpendicular transfer CCD is the 1st field, as shown in drawing 2 (b), and it shifts perpendicularly 1 pixel. Thereby, the picture signal equivalent to one frame of an interlace method can be read by

signal read-out for the 2 fields.
[0023] Next, frame read-out mode is explained using drawing 2 (c) and (d). in frame read-out mode, the charge which flew 1 pixel perpendicularly, came out to it in the 1st field (drawing 2 (c)) first, and was accumulated in photo diode is transmitted to the perpendicular transfer CCD, and this is outputted outside through the level transfer CCD. and the 2nd field -- setting (drawing 2 (d)) -- the charge of the photo diode which was not transmitted to the perpendicular transfer CCD in the 1st field is transmitted to the perpendicular transfer CCD, and this is outputted outside through the level transfer CCD. Thus, in frame read-out mode, it is outputted outside, without mixing the charge on photo diode by the perpendicular transfer CCD. Thereby, the picture signal equivalent to one frame of an interlace method can be read by signal read-out for the 2 fields.
[0024] Drawing 3 is the color filter array Fig. of the complementary color check type formed on a solid state image sensor 3. Among drawing 3 , in a Magenta and G, Green and Ye express yellow and Cy expresses [Mg] each color of cyanogen. The color filter of one color corresponds to 1 pixel of photodiodes as shown in drawing 3 .
[0025] Drawing 4 is the block diagram showing the example of a configuration of the signal composition means 7. In this drawing, 701 is a two-line addition means to add the picture signal for 2 horizontal-scanning Rhine of the picture signal outputted from an image memory 6 (in addition, the picture signal equivalent to horizontal scanning Rhine is only hereafter called level Rhine or a level Rhine signal). 702 is a interpolation means to perform vertical interpolation processing to the picture signal outputted from an image memory 6. The weighting addition means 703 is a means which carries out weighting addition of the output of 2 level Rhine addition means 701 and the interpolation means 702.
[0026] Drawing 5 is the block diagram showing the example of a configuration of 2 level Rhine addition means 701. In this drawing, 70101 is one-line memory and is a means by which only 1 horizontal-synchronization period makes the amount of [of the picture signal outputted from the image memory 6] one line delayed. 70102 is an adder and addition of the upper and lower sides of two lines which adjoin by the level Rhine signal delayed in the one-line memory 70101 and the level Rhine signal inputted into 2 level Rhine addition means 701 being added in this adder 70102 is performed.
[0027] Drawing 6 is the block diagram showing the configuration of the interpolation means 702. In this drawing, 70201 and 70202 are one-line memory and are a means by which only 1 horizontal-synchronization period makes the amount of [of the picture signal outputted from the image memory 6] one line delayed. 70203 and 70204 are amplifier means and carry out the multiplication of the fixed gain to the input signal from an image memory 6, and the output signal of the one-line memory 70202. 70205 is an adder and adds the signal by which multiplication was carried out in gain with the amplifier means 70203 and 70204.
[0028] Drawing 7 is the block diagram showing the configuration of the weighting addition means 703. In this drawing, 70301 is a synthetic multiplier generating means, generates a certain multiplier k (1>=k>=0) according to the signal level for every pixel of a signal which passed through 2 level Rhine addition means 701 here, and gives k and the value 1-k Becoming to multipliers 70302 and 70303. Multiplication is carried out to the signal which passed through the signal and 2 level Rhine addition means 701 which Multipliers 70302 and 70303k and 1-k were passed through the interpolation means 702, and this result is added and outputted with an adder 70304.
[0029] The actuation is explained below about the solid state camera of the gestalt 1 of operation of this invention constituted as mentioned above. In the gestalt 1 of operation of this invention, it is characterized by photoing two images, a short-time exposure signal (this being called a short signal below) and a long duration exposure signal (this being called a long signal below), and photoing the image to which the dynamic range was expanded by compounding this. The principle of such dynamic range expansion is explained using drawing 8 . Drawing 8 (a) and (b) show the brightness (the amount of incident light to a solid state image sensor) of the photographic subject at the time of exposure, and the relation of the amount of signals outputted from a solid state image sensor. The amount of signals outputted

with natural [as shown in drawing 8 (a), the amount of charges generated on the photo diode of a solid state image sensor by incident light is large at the time of prolonged exposure, and] also becomes large. However, if an upper limit exists in the amount of charges accumulated in photo diode and this upper limit is exceeded, the phenomenon in which saturation, i.e., a signal, is crushed occurs and a photographic subject image cannot be reproduced correctly. Conversely, although it is possible to avoid saturation if the exposure time is short set up as shown in drawing 8 (b), S/N of the low brightness part within a photographic subject deteriorates shortly. Then, if the image with which the low brightness section consists of a short signal using the signal (long signal) acquired by long duration exposure and the signal (short signal) acquired by short-time exposure is compounded, a long signal and the high brightness section can reproduce from the low brightness section of a photographic subject to the high brightness section, and will become possible [expanding the dynamic range of image pick-up equipment]. In this case, if it compounds after multiplying a short signal by the gain equivalent to the ratio (ratio of the exposure time) of light exposure with a long signal (drawing 8 (c)), as shown in drawing 8 (d), expansion of the dynamic range according to the ratio of light exposure is realizable. For example, when the light exposure ratio (exposure-time ratio) of a long signal and a short signal is 1:D, a dynamic range can be expanded by D times. Hereafter, according to the above-mentioned principle, the example of image pick-up equipment in which the dynamic range of a photography image is expandable is explained. First, the photography approach of a short signal and a long signal is explained using drawing 9 . Drawing 9 is a timing chart about read-out of the signal which the photographic subject image in a solid state image sensor 3 exposed and exposed. The signal with which the switching condition of the machine shutter 2 is outputted for the read-out control pulse by which (a) controls a vertical synchronizing signal and (b) controls signal-charge read-out from the photo diode of a solid state image sensor 3 in this drawing, and (c), and the exposure signal on the photo diode of a solid state image sensor 3 and (e) are outputted for (d) from a solid state image sensor 3 is shown. At the time of exposure of a short signal, the machine shutter 2 is changed into an open condition, and it performs exposure for 1, exposure time [required],/[for example,], 1000 seconds using an electronic shutter function. After the exposure for 1 / 1000 seconds is completed, the stored charge on photo diode is moved to the perpendicular transfer CCD by the read-out control pulse. At this time, a solid state image sensor 3 mixes the stored charge on photo diode on the perpendicular transfer CCD, as it shall drive in field read-out mode and drawing 2 (a) explained, and it reads it outside. Under the present circumstances, the picture signal to read is made only into the signal for the 1st field. The short signal read to drawing 10 in field read-out mode is shown. In addition, let the number of the photo diodes of the perpendicular direction of a solid state image sensor 3 be N individual (it not to be the thing of explanation to restrict to this for convenience, although N considers as even number.). The short signal read as shown in drawing 10 turns into Ye+Mg, Cy+G, Ye+G, and four kinds of signals of Cy+Mg with which the signal of four colors of Ye, Cy, G, and Mg was added, respectively. Moreover, the number of Rhine of the perpendicular direction is set to one half of the numbers N of the perpendicular direction of photo diode. Next, a long signal is exposed while having read the short signal. The exposure period of a long signal is made for example, into 1 / 100 seconds. The exposure time of a long signal shall be controlled by closing motion of the machine shutter 2, after [of a long signal] after [exposure initiation] 1 / 100 seconds, closes the machine shutter 2 and completes exposure. Thus, by closing the machine shutter 2, the signal which carried out long duration exposure is read, and is not exposed too much in inside. It will read, if exposure of a long signal is completed, and the stored charge on photo diode is transmitted to the perpendicular transfer CCD by the control pulse. At this time, a solid state image sensor 3 reads the charge of the photo diode which is equivalent to odd lines of a perpendicular direction as it shall drive in frame read-out mode and drawing 2 (c) explained by the 1st field. Reading the charge of the photo diode equivalent to even lines of a perpendicular direction shortly after signal read-out termination of the 1st field, (the 2nd field) a long signal reads the signal equivalent to one frame from a solid state image sensor 3 by this. In addition, the period of the Vertical

Synchronizing signal shown in drawing 9 (a) shall be made for example, into 1 / 100 seconds, and signal read-out for the 1 field from a solid state image sensor 3 shall be completed within 1 period of a Vertical Synchronizing signal. The long signal read to drawing 11 in frame read-out mode is shown. In the 1st field, the long signal read as shown in drawing 11 serves as a signal of two colors of Ye and Cy, and the 2nd field serves as a signal of two colors of G and Mg. Moreover, the number of Rhine of the perpendicular direction is 1/2 of the number N of the perpendicular direction of photo diode in each field, and if the two fields are doubled, it will serve as a signal of N Rhine equivalent to one frame. It is possible to acquire two signals with which the exposure times differ, i.e., the short signal which is 1 field image and the long signal which is an one-frame image, by performing the above exposure and signal read-out. In addition, since the number of level Rhine of a short signal is 1/2 of a long signal, the short signal is a signal with few pixels compared with the long signal. Next, two signals with which the exposure times acquired with the solid state image sensor 3 differ are changed into a digital signal by the A/D-conversion means 5 through the analog signal processing means 4, and are once memorized in an image memory 6. A long signal and a short signal are read from an image memory 6. In addition, in case a long signal is read from an image memory 6, it is concluded as an one-frame image that it says that long signals are the 1st line of the 1st field, the 1st line of the 2nd field, and the 2nd line of the 1st field. Suppose that it is read sequentially from head Rhine of a ** case. The long signal read from the image memory 6 is sent to 2 level Rhine addition means 701. In 2 level Rhine addition means 701, when it sees as a frame signal, addition mixing of the long signal of the adjoining upper and lower sides of two lines is carried out. In case it compounds a long signal and a short signal, this is because composition is impossible, when the signal formats of two signals differ, therefore, performs the same processing as pixel mixing on the perpendicular transfer CCD of a solid state image sensor 3 with 2 level Rhine addition means 701 to a long signal, and changes 1 field image into an one-frame image with the interpolation means 702 to a short signal. The short signal before interpolation processing is shown in drawing 12 (b), and the short signal after interpolation processing is shown for the long signal after addition mixing of the signal of the upper and lower sides of two lines which adjoin drawing 12 (a) in 2 level Rhine addition means 701 was carried out in drawing 12 (c). As it is indicated in (c) as drawing 12 (a), the signal format of a long signal and a short signal agrees by 2 level Rhine addition processing to a long signal, and interpolation processing to a short signal. Although the field image shown in drawing 12 (b) is changed into the frame image shown in this drawing (c) by interpolation processing with the interpolation means 702, the approach is explained below. For example, when searching for the level Rhine signal between the 2nd line in drawing 12 (b), and the 3rd line by interpolation processing, it is necessary to build Ye+G and the level Rhine signal which consists of a signal of Cy+Mg. Since Rhine which consists of nearest Ye+G and a signal of Cy+Mg at this time is the 2nd line and the 4th line, they asks these both for Rhine between the 2nd line and the 3rd line by interpolation processing. However, since the spatial distance of the 2nd line and the 4th line [the location which searches for a level Rhine signal by interpolation processing, and] is not the equal distance, according to the distance, weighting is needed. Then, what is necessary is to carry out weighting of the number by which it multiplies with these multipliers 70203 and 70204 as 1/4 and 3/4, respectively, and just to add that multiplication result with an adder 70205 in the interpolation means 702, since Rhine of the vertical both ends except a core is the configuration of being inputted into multipliers 70203 and 70204, among the level Rhine signals of three lines inputted continuously. In addition, the number by which multiplication is carried out with multipliers 70203 and 70204 is determined as the location which searches for a level Rhine signal by interpolation processing from a with a spatial distance [with the 2nd line and the 4th line] ratio being 1:3. When similarly the level Rhine signal between the 3rd line and the 4th line is searched for by interpolation processing, Since Rhine where the need of building Ye+Mg and the level Rhine signal which consists of a signal of Cy+G consists of nearest Ye+Mg and a signal of Cy+G at ** and this time is the 3rd line and the 5th line, Weighting according to the ratio of distance with these both can be performed, and it can ask for Rhine between the 3rd line and the 4th

line by interpolation processing.
[0030] The signal which is equivalent to one frame pass interpolation processing since the long signal for one frame and the short signal for the 1 field with the above processing is generated.
[0031] A means to compound these long(s) signal and a short signal and to compound the signal to which the dynamic range was expanded is the weighting addition means 703. It asks for the synthetic multiplier k according to the signal level for every pixel of a long signal with the synthetic multiplier generating means 70301 shown in drawing 7 in the weighting addition means 703, and a long signal and the short signal which became an one-frame image by interpolation processing which exists in the same spatial position on a screen are compounded per 1 pixel according to this synthetic multiplier k.
[0032] Drawing 13 is an example of the approach of asking for the synthetic multiplier k for every pixel from the signal level of the long signal in the synthetic multiplier generating means 70301. As shown in drawing 13 , two threshold Th#min and Th#max are set up to long signal level, when long signal level is (several 1) (i.e., when the possibility of saturation does not have the signal level of a long signal below at Th#min), the synthetic multiplier k is set to 0, and when long level is (several 2) (i.e., when the output of a solid state image sensor has long signal level close to saturation level above Th#max), the synthetic multiplier k is set to 1. In addition, threshold Th#max and Th#min are suitably determined according to saturation characteristics and S/N of a solid state image sensor to be used.
[0033]
[Equation 1]
$0 \leqq \text{long 信号レベル} \leqq Th\_min$

[0034]
[Equation 2]
$Th\_max \leqq \text{long 信号レベル}$

[0035] Moreover, when long signal level is (several 3) (i.e., when long signal level is middle), as shown in drawing 13 , the synthetic multiplier k is determined by the primary formula of (several 4).
[0036]
[Equation 3]
$Th\_min < \text{long 信号レベル} < Th\_max$

[0037]
[Equation 4]
$$k = \{1/(Th\_max - Th\_min)\} \times (\text{long 信号レベル}) - \{Th\_min/(Th\_max - Th\_min)\}$$

[0038] A long signal and a short signal are compounded by (several 5) for every pixel using the synthetic multiplier k called for as mentioned above. The signal which compounded the long signal and the short signal is made into a composite signal.
[0039]
[Equation 5]
$\text{合成信号} = (1 - k) \times \text{long 信号} + k \times \text{short 信号} \times D$

[0040] For example, when searching for a composite signal (Ye+Mg) M11 from the long signal (Ye+Mg) L11 shown in drawing 14 , and the short signal (Ye+Mg) S11 with this (Ye+Mg) same L11 and space position, composition will be performed if the synthetic multiplier determined from a long signal is set to k11 (several 6).
[0041]
[Equation 6]
$(Ye+Mg)M11 = (1 - k11) \times (Ye+Mg)L11 + k11 \times (Ye+Mg)S11 \times D$

[0042] It asks like [other pixels of a composite signal] (several 6) from the long signal and

short signal which exist in the same space position.
[0043] In addition, the constant D by which sets to reach (several 5) (several 6) and multiplication is carried out to a short signal is the ratio (ratio of the exposure time) of the light exposure of a long signal and a short signal, for example, if light exposure (exposure time) of TL and a short signal is set to TS for the light exposure (exposure time) of a long signal, D will be calculated by (several 7).
[0044]
[Equation 7]
$$D=TL/TS$$

[0045] A long signal and a short signal are used. The signal level of a long signal the part below threshold Th#min Thus, a long signal, For this signal level, the output of more than threshold Th#max3, i.e., a solid state image sensor, is a part (the brightness of a photography image is high) near being saturated. If it usually becomes, a part by which a signal is crushed is compounding a short signal and the composite signal with which the part of the middle brightness consists of a signal which carried out weighting addition of a long signal and the short signal, and can expand the dynamic range of the photoed picture signal.
[0046] However, since the part which consists of a long signal among the composite signals with which dynamic range expansion was made is originally the picture signal of one frame, its image resolution is high. On the other hand, since the part which consists of a short signal is compounded from the picture signal of the 1 field, compared with the part which consists of a long signal, image resolution is low. However, generally photography conditions to which the signal level of the whole screen becomes close to saturation are rare, since an optical diaphragm is narrowed down also under such conditions and the amount of incident light is restricted, the signal level of the whole screen does not turn into level near saturation, and it cannot seldom happen on real use that the part which consists of a short signal occupies most photography images. Moreover, when the limited gradation expresses an image, compared with low and the inside brightness section, as for a high, the high brightness section, i.e., signal level, part, gradation is assigned fewer in many cases. For this reason, resolution degradation of the part which consists of a short signal is not so much conspicuous, and even if it compounds a long signal and a short signal by the above approaches, it is thought that the synthetic image of the resolution of the number average of pixels of CCD is obtained.
[0047] As for the composite signal compounded in the signal composition means 7, in the digital-signal-processing means 8, processing of encoding to separation of brightness and a chrominance signal, noise rejection, edge enhancement, a gamma correction, a matrix operation, and a specific format etc. is performed as above. Since it is directly [the purpose of the invention in this application, and] unrelated about signal processing in the digital-signal-processing means 8, detailed explanation is omitted.
[0048] As mentioned above, in the solid state camera of the gestalt 1 of operation of this invention, exposure of a solid state image sensor 3 and signal read-out mode are controlled, and the image to which the dynamic range was also expanded can be photoed by photoing the short-time exposure signal for the 1 field, and the prolonged exposure signal for one frame, and compounding these, having the resolution of the number average of pixels of CCD. Since IT-CCD generally used for the solid state image sensor furthermore used with this solid state camera with the noncommercial solid state camera is usable, it is not necessary to use two or more solid state image sensors and special solid state image sensors, and equipment can be constituted cheaply.
[0049] (Gestalt 2 of operation) The processings made with the configuration of a weighting addition means (a number is assigned with 704 and it distinguishes with the gestalt 2 of this operation) and this means differ to the gestalt 1 of operation of this invention which showed the solid state camera in the gestalt 2 of operation of this invention to drawing 1 . About a part for the same processing content block as the gestalt 1 of operation of this invention, explanation is omitted hereafter, and only a different part from the gestalt 1 of operation of this invention is explained.

[0050] Drawing 15 is the block diagram of the weighting addition means 704 in the gestalt 2 of operation of this invention. In this drawing, 70401 is a luminance-signal extract means to extract a luminance-signal component from the long signal which passed through 2 level Rhine addition means 701. 70402 is a synthetic multiplier generating means, generates a certain multiplier k (1>=k>=0) according to the luminance-signal level of the brightness component of the long signal which passed through the luminance-signal extract means 70401 here, and gives k and the value 1-k Becoming to multipliers 70403 and 70404. Multiplication is carried out to the long signal which passed through the short signal and 2 level Rhine addition means 701 which Multipliers 70403 and 70404k and 1-k were passed through the interpolation means 702, and this result is added and outputted with an adder 70405.
[0051] Drawing 16 is the block diagram showing the example of a configuration of the luminance-signal extract means 70401. In this drawing, 704011 is a means by which only the period for 1 pixel delays an input signal. 704012 is an adder, and 2-pixel addition which adjoins horizontally by adding the pixel signal inputted into the pixel signal delayed in the 1-pixel delay means 704011 and the luminance-signal extract means 70401 in this adder 704012 is performed, and it extracts only the low-pass component of a signal. It is equivalent to the luminance signal of the low-pass component of a signal, i.e., a picture signal, extracted by the luminance-signal extract means 70401.
[0052] The actuation is explained below about the solid state camera of the gestalt 2 of operation of this invention constituted as mentioned above. Unlike the gestalt 1 of operation of this invention, the synthetic multiplier used in case a long signal and a short signal are compounded in the gestalt 2 of operation of this invention is determined based on the signal level of the luminance signal extracted from the long signal. Therefore, it has the luminance-signal extract means 70401 which is a means to extract a luminance signal from a long signal in the weighting addition means 704.
[0053] In the luminance-signal extract means 70401, the brightness component (this is called a long luminance signal below) of a long signal is extracted based on (several 8) of the following [carrying out sequential addition of the 2-pixel signal which adjoins each other horizontally among the outputs of 2 level Rhine addition means 701].
[0054]
[Equation 8]
輝度成分（輝度信号）＝Ye+Mg+Cy+G

[0055] For example, when searching for the long luminance signal YL11 from the long signal (Ye+Mg) L11 and the long signal (Cy+G) L12 which are shown in drawing 17 , L (Ye+Mg)11 and L (Cy+G)12 will be added. When searching for the long luminance signal YL12 similarly, L (Cy+G)12 and L (Ye+Mg)13 are added. How to determine a synthetic multiplier based on the luminance signal (long luminance signal) extracted from the long signal is explained below.
[0056] Drawing 18 is an example of the approach of asking for the synthetic multiplier k for every pixel from the signal level of the long luminance signal in the synthetic multiplier generating means 70402. the intensity level of a photographic subject as shown in drawing 18 , when two threshold Th#min' and Th#max' are set up to long luminance-signal level and long luminance-signal level is (several 9) that is, -- Th#min' -- the intensity level of a photographic subject when the synthetic multiplier k is set to 0 when it is the following low brightness, and long luminance-signal level is (several 10) that is, -- Th#max' -- when it is the above high brightness, the synthetic multiplier k is set to 1. In addition, according to threshold Th#max', the saturation characteristics of the solid state image sensor which Th#min' uses, or S/N, it determines suitably.
[0057]
[Equation 9]
0 ≦long 輝度信号レベル≦Th_min'

[0058]
[Equation 10]
Th_max' ≦long 輝度信号レベル

[0059] Moreover, when long luminance-signal level is (several 11) (i.e., when brightness is the middle of low brightness and high brightness), as shown in drawing 18 , the synthetic multiplier k is determined by the primary formula of (several 12).
[0060]
[Equation 11]
Th_min' <long輝度信号レベル<Th_max'

[0061]
[Equation 12]
k = {1/ (Th_max' −Th_min') } × (long輝度信号レベル)
— {Th_min' / (Th_max' −Th_min') }

[0062] A long signal and a short signal are compounded by (several 5) for every pixel using the synthetic multiplier k called for as mentioned above. The signal which compounded the long signal and the short signal is made into a composite signal.
[0063] For example, when searching for a composite signal (Ye+Mg) M11 from the long signal (Ye+Mg) L11 shown in drawing 19 , and the short signal (Ye+Mg) S11 with this (Ye+Mg) same L11 and space position, composition is performed by (several 13) based on the synthetic multiplier (this is set to ky11) determined from these two signals and the long luminance signal YL11 with the same space position. [0064]
[Equation 13]
(Ye+Mg)M11= (1 − k y11) × (Ye+Mg) L11 + k y11 × (Yc+Mg) S11 × D

[0065] It asks like [other pixels of a composite signal] (several 13) from the long signal and short signal which exist in the same space position.
[0066] In addition, the constant D by which multiplication is carried out to a short signal in (several 13) is the ratio (ratio of the exposure time) of the light exposure of a long signal and a short signal like the gestalt 1 of operation of this invention, and is called for by (several 7).
[0067] Thus, it is compounding the composite signal which consists of a signal with which, as for the low brightness section, the part of the brightness in the middle of a short signal, the low brightness section, and the high brightness section in a long signal and the high brightness section carried out weighting addition of a long signal and the short signal using the long signal and the short signal, and it is possible to expand the dynamic range of the photoed picture signal. Moreover, since it can be called the low-frequency component extracted from a long signal, a luminance signal can reduce the effect which the noise component in a long signal does to synthetic multiplier decision, when asking for a synthetic multiplier based on this luminance signal.
[0068] As mentioned above, also in the solid state camera of the gestalt 2 of operation of this invention, exposure of a solid state image sensor 3 and signal read-out mode are controlled, and the image to which the dynamic range was expanded can be photoed by photoing the short-time exposure signal for the 1 field, and the prolonged exposure signal for one frame, and compounding these, having the resolution of the number average of pixels of CCD. Since IT-CCD generally used for the solid state image sensor furthermore used with this solid state camera with the noncommercial solid state camera is usable, it is not necessary to use two or more solid state image sensors and special solid state image sensors, and equipment can be constituted cheaply.
[0069] (Gestalt 3 of operation) Drawing 20 is the block diagram of the solid state camera in the gestalt 3 of operation of this invention. In this drawing, since the function of an optical lens 1, an optical diaphragm and the machine shutter 2 of combination, a solid state image sensor 3, the analog signal processing means 4, the A/D-conversion means 5, an image memory 6, the shutter driving means 9, the solid state image sensor driving means 10, 2 level Rhine addition means 701, the luminance-signal extract means 70401, and the interpolation means 702 and actuation are the same as that of the gestalt 1 of operation of this invention, and the gestalt 2 of operation, the same number as drawing 19 is attached from drawing 1 ,

and explanation is omitted.
[0070] In the block diagram shown in drawing 20 , when components other than the above are explained, 12 is a luminance-signal interpolation means to perform vertical interpolation processing to the output of the luminance-signal extract means 70401, and the luminance-signal composition means 13 is a means to compound the output of the luminance-signal extract means 70401 and the luminance-signal interpolation means 12. In addition, since the luminance signal inputted into the luminance-signal interpolation means 12 is a luminance signal extracted from the short signal, it is called a short luminance signal, and the luminance signal extracted from a long signal is called a long luminance signal. Therefore, the signal with which the signal inputted into the luminance-signal composition means 13 is inputted into the luminance-signal composition means 13 from a long luminance signal and the luminance-signal interpolation means 12 turns into a signal after interpolation processing of a short luminance signal from the luminance-signal extract means 70401 directly.
[0071] Moreover, the signal composition means 14 is a means to compound the output of the two-line addition means 701 and the interpolation means 702. In case the one-line memory 15, 16, 17, and 18 carries out synchronization of the output of the signal composition means 14, it is a delay means for required 1 horizontal-synchronization period, and it acquires the signal which has a red (R) component in the same spatial position, and a signal with a blue (B) component with the synchronization means 19 from a total of the level Rhine signal of five lines of the output of the one-line memory 15, 16, 17, and 18, and the output of the signal composition means 14.
[0072] In the digital-signal-processing means 20, as for the luminance signal acquired with the luminance-signal composition means 13, a signal with the red (R) component obtained with the synchronization means 19, and the signal with a blue (B) component, processing of encoding to noise rejection, edge enhancement, a matrix operation, and a specific format etc. is performed. In addition, the modes of operation and the timing of operation of a component of all above including these shall be controlled by the system control means 21 integrative.
[0073] Drawing 21 is the block diagram showing the configuration of the luminance-signal interpolation means 12. In this drawing, 1201 is one-line memory and is a means by which only 1 horizontal-synchronization period makes the amount of [of the picture signal outputted from the luminance-signal extract means 70401] one line delayed. 1202 and 1203 are amplifier means and carry out the multiplication of the fixed gain to the signal inputted into the luminance-signal interpolation means 12 through the signal and the luminance-signal extract means 70401 which it passed through 1201, respectively. 1204 is an adder and adds the signal by which multiplication was carried out in gain with the amplifier means 1202 and 1203.
[0074] Drawing 22 is the block diagram showing the configuration of the luminance-signal composition means 13. In this drawing, 1301 is a synthetic multiplier generating means, generates a certain multiplier k (1>=k>=0) according to the signal level for every pixel of a long luminance signal which passed through the luminance-signal extract means 70401 here, and gives k and the value 1-k Becoming to multipliers 1302 and 1303. The multiplication of Multipliers 1302 and 1303k and the 1-k is carried out to a short luminance signal and a long luminance signal, and this result is added and outputted with an adder 1304.
[0075] Drawing 23 is the block diagram showing the configuration of the signal composition means 14. In this drawing, 1401 and 1402 are multipliers and are a multiplier which carries out the multiplication of the multiplier k supplied from the luminance-signal composition means 13, and the 1-k to a short signal and the long signal after 2 level Rhine addition, respectively. This multiplication result is added and outputted with an adder 1403.
[0076] Drawing 24 is the block diagram showing the configuration of the synchronization means 19. In this drawing, 1901 chooses three signals from the signal inputted, the selector outputted to an output A, an output B, and an output C, and 1902 and 1903 are amplifier means which carry out the multiplication of the constant in the signal outputted from an output B and an output C, and the signal after this multiplication is added with an adder 1904. 1905 is a selector which distributes the output A of a selector 1901, and the output of an

adder 1904 to an output D and an output E, and outputs them. In addition, suppose that selection of the output destination change of the signal by selectors 1901 and 1905 can be distributed by the color component of a signal as below-mentioned.
[0077] The actuation is explained below about the solid state camera of the gestalt 3 of operation of this invention constituted as mentioned above. Also in the gestalt 3 of operation of this invention, the point which photos two images, a short-time exposure signal (short signal) and a long duration exposure signal (long signal), and photos the image to which the dynamic range was expanded by compounding this is the same as the gestalten 1 and 2 of operation of this invention. However, in the gestalt 3 of operation of this invention, it is characterized by performing composition of a short-time exposure signal (short signal) and a long duration exposure signal (long signal) according to an individual by the luminance signal and the signal processed as a chrominance signal behind. Therefore, addition mixing of the long signal of the upper and lower sides of two lines which adjoin when the long signal read from the image memory 6 like the case of the gestalt 1 of operation of this invention is seen as a frame signal in 2 level Rhine addition means 701 in the gestalt 3 of operation of this invention is carried out. Since pixel mixing of the short signal is carried out on the perpendicular transfer CCD of a solid state image sensor 3, this is a measure for doubling a long signal with this.
[0078] In the luminance-signal extract means 70401, the brightness component (this is called a long luminance signal below) of a long signal is extracted based on (several 8) by carrying out sequential addition of the 2-pixel signal which adjoins each other horizontally among the outputs of 2 level Rhine addition means 701 like the gestalt 2 of operation of this invention.
[0079] For example, when searching for the long luminance signal YL11 from the long signal (Ye+Mg) L11 and the long signal (Cy+G) L12 which are shown in drawing 17 , L (Ye+Mg)11 and L (Cy+G)12 will be added. When searching for the long luminance signal YL12 similarly, L (Cy+G)12 and L (Ye+Mg)13 are added.
[0080] Next, as for the short signal read from an image memory 6, in the luminance-signal extract means 70401, a luminance signal is first searched for like the case of a long signal.
[0081] A long luminance signal is shown in drawing 25 , and a short luminance signal is shown in drawing 26 .
[0082] As shown in drawing 26 , since the short signal was a signal of the 1 field, naturally a short luminance signal is also a luminance signal of the 1 field. Then, the means for changing the short luminance signal of this 1 field into the signal of one frame, and making a long luminance signal and a signal format the same is the luminance-signal interpolation means 12.
[0083] Specifically, the luminance-signal interpolation means 12 makes this a interpolation signal in quest of the addition average of two lines which continues by setting to 0.5 gain which carries out multiplication with the amplifier means 1202 and 1203 shown in drawing 21 . The short luminance signal after interpolation processing is shown in drawing 27 .
[0084] The luminance signal (long luminance signal) acquired from the long signal for one frame and the luminance signal (short luminance signal) equivalent to one frame pass interpolation processing since the short signal for the 1 field are generated by the above processing. Thus, in case the reason for having compounded the short luminance signal of one frame from the short signal of the 1 field compounds a short signal and a long signal and aims at dynamic range expansion, it is because level Rhine which constitutes an image while the short signal has been a signal of the 1 field runs short and it cannot compound with the long signal which is a signal of one frame.
[0085] A means to compound these long(s) luminance signal and a short luminance signal, and to compound the luminance signal to which the dynamic range was expanded is the luminance-signal composition means 13. It asks for the synthetic multiplier k according to the signal level for every pixel of a long luminance signal with the synthetic multiplier generating means 1301 shown in drawing 22 in the luminance-signal composition means 13, and a long luminance signal and the short luminance signal which exists in the same spatial position on a screen are compounded per 1 pixel according to this synthetic multiplier k.
[0086] Since the approach same as an example of the approach of asking for the synthetic

multiplier k for every pixel from the signal level of a long luminance signal as the gestalt 2 of operation of this invention can be considered, explanation is omitted.
[0087] A long luminance signal and a short luminance signal are compounded by (several 14) for every pixel using the called-for synthetic multiplier k. The signal which compounded the long luminance signal and the short luminance signal is made into a synthetic luminance signal.

[0088]
[Equation 14]
合成輝度信号＝（１－ｋ）×long 輝度信号　＋　ｋ×short 輝度信号×D

[0089] For example, when searching for the synthetic luminance signal YM11 from the long luminance signal YL11 shown in drawing 28 , and the short luminance signal YS11 with this same YL11 and space position, composition will be performed if the synthetic multiplier determined from a long luminance signal (YL11) is set to k11 (several 15).
[0090]
[Equation 15]
$$YM11 = (1 - k11) \times YL11 + k11 \times YS11 \times D$$

[0091] It asks like [other pixels of a synthetic luminance signal] (several 15) from the long luminance signal and short luminance signal which exist in the same space position.
[0092] in addition -- and (several 14) (several 15) the constant D by which sets and multiplication is carried out to a short luminance signal -- the ratio (ratio of the exposure time) of the light exposure of a long signal and a short signal -- it is (several 7) -- it asks.
[0093] Thus, it is compounding the synthetic luminance signal which consists of a signal with which, as for the low brightness section, the part of the brightness in the middle of a short luminance signal, the low brightness section, and the high brightness section in a long luminance signal and the high brightness section carried out weighting addition of a long luminance signal and the short luminance signal using the long luminance signal and the short luminance signal, and it is possible to expand the dynamic range of the luminance signal of the photoed image.
[0094] However, since the part which consists of a long luminance signal among the luminance signals with which dynamic range expansion was made is originally the picture signal of one frame, its image resolution is high. On the other hand, since the part which consists of a short luminance signal is compounded from the picture signal of the 1 field, compared with the part which consists of a long luminance signal, image resolution is low. However, generally the bottom of a photography condition from which the whole screen serves as high brightness is rare, since an optical diaphragm is narrowed down also under such conditions and the amount of incident light is restricted, the whole screen does not serve as high brightness and it cannot seldom happen on real use that the part which consists of a short luminance signal occupies most photography images. Moreover, when the limited gradation expresses an image, compared with low and the inside brightness section, as for the high brightness section, gradation is assigned fewer in many cases. For this reason, resolution degradation of the part which consists of a short luminance signal is not so much conspicuous, and even if it compounds a long luminance signal and a short luminance signal by the above approaches, it is thought that the synthetic image of the resolution of the number average of pixels of CCD is obtained.
[0095] The above is the contents of processing about the dynamic range expansion by composition of a luminance signal. Next, the processing about a chrominance signal is explained.
[0096] Synthetic processing for dynamic range expansion of a chrominance signal is performed to the short signal read from the image memory 6, and the long signal with which the upper and lower sides of two lines which adjoin in 2 level Rhine addition means 701 were added in the signal composition means 14.
[0097] In addition, since a short signal is 1 field signal, the long signal and signal format which are an one-frame signal differ from each other. Therefore, 1 field image is changed into an

one-frame image with the interpolation means 702 like the gestalt 1 of operation of this invention. The short signal by which interpolation processing was carried out in a long signal and the interpolation means 702 after addition mixing of the signal of the upper and lower sides of two lines which adjoin in 2 level Rhine addition means 701 was carried out (c) c [drawing 12 (a), and] Is as being shown, and the signal format of a long signal and a short signal has agreed like the gestalt 1 of operation of this invention by 2 level Rhine addition processing to a long signal, and the interpolation processing to a short signal.

[0098] Composition of the long signal in the signal composition means 14 and a short signal is carried out for every pixel by the synthetic multiplier k used in case the long luminance signal whose location corresponds with the long signal and short signal which are inputted into the signal composition means 14, and a space target like the gestalt 2 of operation of this invention, and a short luminance signal are compounded, and (several 7) D calculated. The signal compounded with the signal composition means 14 is called a composite signal.

[0099] It is synthetic processing for dynamic range expansion of the above of a chrominance signal.

[0100] Now, the composite signal searched for with the signal composition means 14 The configuration Rhine where the pixel of Ye+Mg and Cy+G is horizontally located in a line, and Rhine where the pixel of Ye+G and Cy+Mg is horizontally located in a line are repeated by whose perpendicular direction in a cycle of two line sake, If the red which is the three primary colors of a color, Green, and blue are set to R, G, and B, respectively From Rhine where the pixel of Ye+Mg and Cy+G is located in a line, the chrominance signal which had B component by (several 17) and 2B-G Becoming is acquired from Rhine where Ye+G and Cy+Mg are located in a line by the chrominance signal which had R component by (several 16), and which becomes 2 R-G.

[0101]

[Equation 16]

$$(Ye+Mg) - (Cy+G) \fallingdotseq 2R-G$$

[0102]

[Equation 17]

$$(Cy+Mg) - (Ye+G) \fallingdotseq 2B-G$$

[0103] This is color difference line sequential [so-called], and either 2 R-G in which the chrominance signal had R component, or 2B-G with B component is obtained to 1 level Rhine signal. Then, in order to acquire a signal with the component of the both sides of R component and B component to 1 level Rhine signal, synchronization processing is performed by the Rhine memory 15, 16, 17, and 18 and the synchronization means 19.

[0104] The concrete contents of the synchronization processing by the Rhine memory 15, 16, 17, and 18 and the synchronization means 19 are explained below. The level Rhine signal of five lines which continues from the signal composition means 14 and the Rhine memory 15, 16, 17, and 18 is inputted into the synchronization means 19. Suppose that the signal of five lines which makes a composite signal drawing 29 (a) and is temporarily inputted into the synchronization means 19 in it was the signal compounded with the signal composition means 14 a signal of 3rd line - the 7th line shown in drawing 29 (b). What is necessary is just to make 2B-G with B component by interpolation processing from a surrounding level Rhine signal, since the 5th line is a signal corresponding to 2 R-G with R component supposing the object of synchronization processing presupposes that it is the level Rhine signal located at the core of five lines of being inputted at this time and it performs synchronization processing to the level Rhine signal of the 5th line of drawing 29 (b). Then, in the synchronization means 19 shown in drawing 24 , a selector 1901 outputs the signal corresponding to 2B[of the 3rd line and the 7th line]-G for the signal of the 5th line to an output A at an output B and an output C. Gain which carries out multiplication with the amplifier means 1902 and 1903 is set to 0.5, and if this multiplication result is added with an adder 1904, the averaging result of the 3rd line and the 7th line will be searched for. The signal of the 5th line which is the output of the output A of this averaging result and a selector 1901 is inputted into a selector 1905, an

output destination change is chosen here, and the averaging result of the 3rd line and the 7th line corresponding to [in the level Rhine signal of the 5th line corresponding to 2 R-G] 2B-G to an output D is outputted at an output E. The signal corresponding to 2 R-G which had R component in the spatial position where the 5th line exists by such actuation, and the signal corresponding to 2B-G with B component can be acquired. What is necessary is just to make 2 R-G with R component by interpolation processing from a surrounding level Rhine signal shortly, since the 7th line is a signal corresponding to 2B-G with B component supposing similarly the signal of 5th line - the 9th line is inputted into the synchronization means 19 and it performs synchronization processing to the level Rhine signal which is the 7th line. Then, in the synchronization means 19 shown in drawing 24 , a selector 1901 outputs the signal corresponding to 2 R-G of the 5th line and the 9th line for the signal of the 7th line to an output A at an output B and an output C. Gain which carries out multiplication with the amplifier means 1902 and 1903 is set to 0.5, and if this multiplication result is added with an adder 1904, the averaging result of the 5th line and the 9th line will be searched for. The signal of the 7th line which is the output of the output A of this averaging result and a selector 1901 is inputted into a selector 1905, an output destination change is chosen here and the averaging result of the 5th line and the 9th line corresponding to [in the level Rhine signal of the 7th line corresponding to 2B-G] 2 R-G to an output E is outputted at an output D. The signal corresponding to 2 R-G which had R component in the spatial position where the 7th line exists by such actuation, and the signal corresponding to 2B-G with B component can be acquired. In addition, selection of an I/O signal etc. makes the synchronization means 19 automatic or the thing carried out by control of the system control means 21 so that the above processings may be performed according to an input signal.

[0105] As for the signal corresponding to 2 R-G with R component obtained with the synthetic luminance signal and the synchronization means 19 which were compounded in the luminance-signal composition means 13, and the signal corresponding to 2B-G with B component, in the digital-signal-processing means 20, processing of encoding to noise rejection, edge enhancement, a gamma correction, a matrix operation, and a specific format etc. is performed as above. Since it is directly [the purpose of the invention in this application, and] unrelated about signal processing in the digital signal means 20, detailed explanation is omitted.

[0106] As mentioned above, in the solid state camera of the gestalt 3 of operation of this invention, exposure of a solid state image sensor 3 and signal read-out mode are controlled, and by photoing the short-time exposure signal for the 1 field, and the prolonged exposure signal for one frame, and compounding these, though it has the resolution of the number average of pixels of a solid state image sensor, the image to which the dynamic range was expanded can be photoed. Since IT-CCD generally used for the solid state image sensor furthermore used with this solid state camera with the noncommercial solid state camera is usable, it is not necessary to use two or more solid state image sensors and special solid state image sensors, and equipment can be constituted cheaply.

[0107] (Gestalt 4 of operation) The solid state camera in the gestalt 4 of operation of this invention The infanticide means 22 against the output of 2 level Rhine addition means 70401 is added to the gestalt 3 of operation of this invention shown in drawing 20 . In connection with this, the interpolation means memory 17 and 18 of 702 or 1 line is deleted. Since the points that furthermore a configuration differs from the function of a signal composition means, a synchronization means, a digital-signal-processing means, and a system control means (a number is assigned with the signal composition means 23, the synchronization means 24, the digital-signal-processing means 25, and the system control means 26, and it distinguishes with the gestalt 4 of operation of this invention) are the main differences, About a part for the same processing content block as the gestalt 3 of operation of this invention, explanation is omitted hereafter, and only a different part from the gestalt 3 of operation of this invention is explained. Drawing 30 is the block diagram of the solid state camera in the gestalt 4 of operation of this invention. In this drawing, the infanticide means 22 is a means to thin out the level Rhine signal from the output of 2 level Rhine addition means 701, and to

change an one-frame image into 1 field image. The signal composition means 23 is a means to compound the output of the infanticide means 22 and an image memory 6 based on the synthetic multiplier k asked with the luminance-signal composition means 13. The synchronization means 24 is a means which carries out synchronization processing of the output of the signal composition means 23.
[0108] In the digital-signal-processing means 25, as for the luminance signal acquired with the luminance-signal composition means 13, a signal with the red (R) component obtained with the synchronization means 24, and the signal with a blue (B) component, processing of encoding to noise rejection, edge enhancement, a matrix operation, and a specific format etc. is performed. In addition, the modes of operation and the timing of operation of a component of all above including these shall be controlled by the system control means 26 integrative.
[0109] Drawing 31 is the block diagram showing the configuration of the synchronization means 24. 2401 and 2402 are amplifier means which carry out the multiplication of the constant in the signal which passed through the one-line memory 16 to the signal composition means 23, and the signal after this multiplication is added with an adder 2403. 2404 is a selector which distributes the output of the one-line memory 15, and the output of an adder 2403 to an output D and an output E, and outputs them. In addition, suppose that selection of the output destination change of the signal by the selector 2404 can be distributed by the color component of a signal as below-mentioned. The actuation is explained below about the solid state camera of the gestalt 4 of operation of this invention constituted as mentioned above.
[0110] As the gestalt 3 of operation of this invention explained, the output of 2 level Rhine addition means 701 is a long signal which is an one-frame image. However, since the short signal memorized in the image memory 6 is 1 field image, the way things stand in the signal composition means 23, a long signal and a short signal are uncompoundable. Then, in the gestalt 4 of operation of this invention, the short signal was changed into the signal of one frame by interpolation processing.
[0111] In the gestalt 4 of operation of this invention, even if a chrominance signal does not have amount of information comparable as a luminance signal, using being satisfactory in respect of image quality, the gestalt 3 of operation of this invention changes a long signal into 1 field image, and it compounds it with a short signal in the chrominance-signal composition means 24 by performing vertical infanticide processing conversely to the long signal which is an one-frame image. It is thinning out even lines of the long signal after two-line addition as specifically shown in drawing 12 (a), and thinning out with a means 22, and the long signal inputted into the signal composition means 23 is changed into 1 field image. The long signal after this infanticide serves as a short signal as shown in drawing 12 (b), and same format.
[0112] The long signal and short signal which are 1 field image inputted in the signal composition means 23 are compounded for every pixel by the synthetic multiplier k used in case the long luminance signal whose location corresponds with these signals and space targets, and a short luminance signal are compounded like the gestalt 3 of operation of this invention, and (several 7) D calculated. The signal compounded with the signal composition means 23 is called a composite signal.
[0113] Next, although, as for a composite signal, synchronization processing is made in the synchronization means 24, the signal which unlike the gestalt 3 of operation of this invention is inputted into the synchronization means 24 since a composite signal is 1 field signal is good at three lines of the 2nd line to the 4th line, as shown in drawing 32 (b). The signal corresponding to 2 R-G which had R component like the gestalt 3 of operation of this invention, and the signal corresponding to 2B-G with B component can be acquired from this signal of three lines. For example, what is necessary is to carry out averaging of the signal of the 2nd line and the 4th line, and just to compound the signal corresponding to 2B-G, in order to acquire the signal corresponding to 2 R-G which had R component in the location of the 3rd line, and the signal corresponding to 2B-G with B component.
[0114] Although two signals acquired with the synchronization means 24 are processed like the gestalt 3 of operation of this invention in the digital-signal-processing means 25, since the

composite signal compounded with the signal composition means 23 in the gestalt 4 of operation of this invention is 1 field signal, if there is need, it cannot be overemphasized that conversion in a frame image etc. is made in the digital-signal-processing means 25.
[0115] As mentioned above, also in the solid state camera of the gestalt 4 of operation of this invention, exposure of a solid state image sensor 3 and signal read-out mode are controlled like the gestalt 3 of operation of this invention, and the image to which the dynamic range was expanded can be photoed by photoing the short-time exposure signal for the 1 field, and the prolonged exposure signal for one frame, and compounding these, having the resolution of the number average of pixels of a solid state image sensor. Furthermore, since a chrominance signal is processed as a field signal in the gestalt 4 of operation of this invention, the need number of one-line memory etc. can be reduced and equipment can be constituted more cheaply. In addition, in the gestalt 1 of operation of this invention, although a short signal is used as 1 field image read in field read-out mode, it is not restricted to this, and the configuration which thins out a level Rhine signal perpendicularly, for example, is read is also considered. As shown in drawing 33 , when reading a short signal from a solid state image sensor 3 as an example, the configuration which reads the signal of one line perpendicularly every three lines can be considered. In this case, since a short signal is read without mixing the charge accumulated in the photo diode of two upper and lower sides on the solid state image sensor, it becomes unnecessary 2 level Rhine addition processing it to a long signal. Moreover, in the interpolation processing by the interpolation means 702 shown in drawing 4 , it is necessary to perform interpolation processing so that the number of level Rhine of a short signal may be doubled with a long signal. That is, in the interpolation means 702, the level Rhine signal for two lines will be created by interpolation processing between each level Rhine signal of a short signal. Thereby, a short signal and a long signal become possible [compounding with the weighting addition means 703 which became the same signal format and was shown in drawing 4]. In this case, what is necessary is just to ask for the synthetic multiplier k by the approach as shown in drawing 13 from the signal level of each pixel of the long signal by which vertical 2 level Rhine addition is not carried out. In addition, although 2 level Rhine addition processing to a long signal described it as needlessness when a short signal was thinned out and read in this way, after it does not restrict to this and a long signal and a short signal perform 2 level Rhine addition processing, the configuration which performs synthetic processing is also considered.
[0116] Moreover, in the gestalt 1 of operation of this invention, although two signals with which light exposure differs are made into the short signal which is 1 field image, and the long signal which is an one-frame image, they are not restricted to this, and they are good also as the long signal which is 1 field image depending on the application of a solid state camera, and a short signal which is an one-frame image. In this case, what is necessary is just to ask for the configuration which performs vertical interpolation processing with the interpolation means 702 to a long signal as shown in drawing 34 , and performs addition of the upper and lower sides of two lines which adjoin with 2 level Rhine addition means 701 to a short signal, then the synthetic multiplier which it is good and is used with the weighting addition means 703 from the long signal after interpolation processing. Moreover, since the configuration which asks for a synthetic multiplier from the long signal before interpolation processing is also considered, a corresponding long signal does not exist in the location of even lines of the short signal shown in drawing 34 (a) in this case and the synthetic multiplier k cannot be decided, What is necessary is just to carry out determining a with a location [of a short signal / of even lines] synthetic multiplier etc. from the synthetic multiplier called for from the level Rhine signal of the long signal which exists in the same location as Rhine of the upper and lower sides of even lines of a short signal. Thus, a dynamic range expansion image with the high resolution in the high brightness section can be photoed by searching for a composite signal from the short signal which is the long signal and one-frame image which are 1 field image.
[0117] Moreover, in the gestalt 1 of operation of this invention, and the gestalt 2 of operation of this invention, the interpolation means 702 uses two one-line memory, although it is

considered as the configuration which performs interpolation processing from the signal for 2 level Rhine, it does not restrict it to this, and the configuration which performs interpolation processing by high order interpolation processing from many level Rhine signals further, using much one-line memory further is also considered. Moreover, the configuration which performs the so-called last value interpolation which doubles the number of level Rhine with repeating 1 level Rhine inputted as shown in drawing 35 by a unit of 2 times, and outputting it is also considered.

[0118] In the gestalt 1 of operation of this invention moreover, with the signal composition means 7 The synthetic multiplier k for compounding a long signal and a short signal is not what is restricted to this although it shall ask for every pixel of a long signal. For example, the configuration which calculates the synthetic multiplier k for every pixel from two or more averages, minimum values, maximums, or mean values of signal level of a pixel, The configuration which makes the average, the minimum value, the maximum, or the mean value of k calculated from plurality among the values of k called for for every pixel the synthetic multiplier for every pixel is also considered.

[0119] Moreover, in the gestalt 1 of operation of this invention, the configuration which compounds in quest of a synthetic multiplier to the block which consists of two or more pixels is also considered with the signal composition means 7. For example, in drawing 36 , the long signal (Ye+Mg) L11, and L (Cy+G)12, L (Ye+Mg)13 and L (Cy+G)14 are made into 1 block, respectively. If this, the short signal (Ye+Mg) S11 which exists in homotopic, and S (Cy+G)12, S (Ye+Mg)13 and S (Cy+G)14 are made into 1 block, respectively It is also possible to compound by asking for a synthetic multiplier for every block of this 2-pixel unit. Composition of the block which becomes at this time (Ye+Mg) L11 and L (Cy+G)12, for example, long signals, and the short signals (Ye+Mg) S11 and S (Cy+G)12 will be performed like respectively (several 18), if the synthetic multiplier of this block is set to kb11. (Ye+Mg) (M11 and M (Cy+G)12 are a signal after composition)

[0120]

[Equation 18]

$$(Ye+Mg)M11 = (1-kb11) \times (Ye+Mg)L11 + kb11 \times (Ye+Mg)S11 \times D$$

$$(Cy+G)M12 = (1-kb11) \times (Cy+G)L12 + kb11 \times (Cy+G)S12 \times D$$

[0121] In this case, what is necessary is just to let the synthetic multiplier kb 11 be the synthetic multiplier kb 11 of a block of k which can be found by the approach of one signal level of the long signals (for example, (Ye+Mg), L11 and L (Cy+G)12) included in a block or the average of the long signal (for example, (Ye+Mg), L11 and L (Cy+G)12) included in a block, maximum, the minimum value, and a mean value shown in drawing 13 from either at least. Moreover, the configuration made into the synthetic multiplier kb 11 of a block of the average value of the value (for example, k1, k2 in drawing 36) of k for every pixel called for by the approach shown in drawing 13 from each signal level of the long signal included in a block, maximum, the minimum value, or a mean value is also considered. In addition, it cannot be overemphasized that the number of pixels within a block is not necessarily 2 pixels.

[0122] Moreover, in the gestalt 1 of operation of this invention, with the signal composition means 7, the block which consists of two or more pixels is established, and the configuration used for synthetic processing of each pixel within a block of the synthetic multiplier which can be found by the approach shown in drawing 13 from the long signal level which exists in the specific location within this block, for example, the center position of a block, is also considered. In this case, it is not necessary to ask for a synthetic multiplier for every pixel, and processing can be simplified. In addition, it is not necessary to restrict the location of the pixel used in case it asks for a synthetic multiplier to the center position of a block. Moreover, in the gestalt 1 of operation of this invention, the configuration for which it asks from the short signal which changed the synthetic multiplier k into the frame image instead of a long signal is also considered with the signal composition means 7. Moreover, the configuration which asks for the synthetic multiplier k not from the short signal changed into the frame image but from the short signal which is a field image is also considered. In this case, since

the short signal corresponding to even lines of a long signal does not exist, the way things stand, it cannot determine a synthetic multiplier, so that drawing 12 may show. In this case, what is necessary is just to ask for the synthetic multiplier of the location corresponding to even lines of a long signal from a surrounding short signal or a surrounding synthetic multiplier.

[0123] Moreover, although the example of the approach of asking for the synthetic multiplier k from signal level in the gestalt 1 of operation of this invention was shown in drawing 13 , the decision approach of the synthetic multiplier k is not restricted to this, and the method of determining k nonlinear according to an intensity level, as shown in drawing 37 is also considered.

[0124] Moreover, in the gestalt 2 of operation of this invention, although a short signal is used as 1 field image read in field read-out mode, it is not restricted to this, and the configuration which thins out and reads a level Rhine signal perpendicularly as an example as raised to drawing 33 is also considered. In this case, since a short signal is read without mixing the charge accumulated in the photo diode of two upper and lower sides on the solid state image sensor, it becomes unnecessary 2 level Rhine addition processing it to a long signal. Moreover, in the interpolation processing by the interpolation means 702 shown in drawing 4 , it is necessary to perform interpolation processing so that the number of level Rhine of a short signal may be doubled with a long signal. That is, in the interpolation means 702, the level Rhine signal for two lines will be created by interpolation processing between each level Rhine signal of a short signal. Thereby, a short signal and a long signal become possible [compounding with the weighting addition means 703 which became the same signal format and was shown in drawing 4]. However, since the long signal by which vertical 2 level Rhine addition is not carried out is supplied to the luminance-signal extract means 70401 shown in drawing 15 , it is necessary to it to newly add 2 level Rhine addition processing for a luminance-signal extract for this means. Or the means same in the preceding paragraph of the luminance-signal extract means 70401 as 2 level Rhine addition means 701 is established, and the signal with which 2 level Rhine was added needs to be made to be supplied to the luminance-signal extract means 70401. In addition, although 2 level Rhine addition processing to a long signal described it as needlessness when a short signal was thinned out and read in this way, after it does not restrict to this and a long signal and a short signal perform 2 level Rhine addition processing, the configuration which performs synthetic processing is also considered.

[0125] Moreover, in the gestalt 2 of operation of this invention, although two signals with which light exposure differs are made into the short signal which is 1 field image, and the long signal which is an one-frame image, they are not restricted to this, and they are good also as the long signal which is 1 field image depending on the application of a solid state camera, and a short signal which is an one-frame image. In this case, what is necessary is for the configuration which performs vertical interpolation processing with the interpolation means 702 to a long signal as shown in drawing 34 , and performs addition of the upper and lower sides of two lines which adjoin with 2 level Rhine addition means 701 to a short signal, then the synthetic multiplier which it is good and is used with the weighting addition means 703 just to ask from the luminance signal extracted from the long signal after interpolation processing. Moreover, the configuration which asks for a synthetic multiplier from the luminance signal extracted from the long signal before interpolation processing is also considered. In this case, since a corresponding long signal does not exist in the location of even lines of the short signal shown in drawing 34 (a) and the synthetic multiplier k cannot be decided, What is necessary is just to carry out determining a with a location [of a short signal / of even lines] synthetic multiplier etc. from the synthetic multiplier called for from the luminance signal extracted from the level Rhine signal of the long signal which exists in the same location as Rhine of the upper and lower sides of even lines of a short signal. Thus, a dynamic range expansion image with the high resolution in the high brightness section can be photoed by searching for a composite signal from the short signal which is the long signal and one-frame image which are 1 field image.

[0126] In the gestalt 2 of operation of this invention moreover, with the signal composition means 7 The synthetic multiplier k for compounding a long signal and a short signal is not what is restricted to this although it shall ask for every pixel of a long luminance signal. For example, the configuration which calculates the synthetic multiplier k for every pixel from two or more averages, minimum values, maximums, or mean values of luminance-signal level of a pixel, The configuration which makes the average, the minimum value, the maximum, or the mean value of k calculated from plurality among the values of k called for for every pixel the synthetic multiplier for every pixel is also considered.

[0127] Moreover, in the gestalt 2 of operation of this invention, the configuration which compounds in quest of a synthetic multiplier to the block which consists of two or more pixels is also considered with the signal composition means 7. For example, in drawing 38 , the long signal (Ye+Mg) L11, and L (Cy+G)12, L (Ye+Mg)13 and L (Cy+G)14 are made into 1 block, respectively. If this, the short signal (Ye+Mg) S11 which exists in homotopic, and S (Cy+G)12, S (Ye+Mg)13 and S (Cy+G)14 are made into 1 block, respectively It is also possible to compound by asking for a synthetic multiplier for every block of this 2-pixel unit. Composition of the block which becomes at this time (Ye+Mg) L11 and L (Cy+G)12, for example, long signals, and the short signals (Ye+Mg) S11 and S (Cy+G)12 will be performed like respectively (several 18), if the synthetic multiplier of this block is set to kb11. In this case, what is necessary is just to let the synthetic multiplier kb 11 be the synthetic multiplier kb 11 of a block of k which can be found by the approach of one signal level of the long luminance signals (for example, YL11 and YL12 in drawing 38) corresponding to a block or the average of the long luminance signal corresponding to a block, maximum, the minimum value, and a mean value shown in drawing 18 from either at least. Moreover, the configuration made into the synthetic multiplier kb 11 of a block of the average value of the value (for example, k1, k2 in drawing 38) of k for every pixel called for by the approach shown in drawing 18 from each signal level of the long luminance signal corresponding to a block, maximum, the minimum value, or a mean value is also considered. In addition, it cannot be overemphasized that the number of pixels within a block is not necessarily 2 pixels.

[0128] Moreover, in the gestalt 2 of operation of this invention, with the signal composition means 7, the block which consists of two or more pixels is established, and the configuration used for synthetic processing of each pixel within a block of the synthetic multiplier which can be found by the approach shown in drawing 18 from the long luminance-signal level corresponding to the specific location within this block, for example, the center position of a block, is also considered. In this case, it is not necessary to ask for a synthetic multiplier for every pixel, and processing can be simplified. In addition, it is not necessary to restrict the location of the pixel used in case it asks for a synthetic multiplier to the center position of a block. Moreover, in the gestalt 2 of operation of this invention, the configuration for which it asks from the luminance signal (short luminance signal) extracted from the short signal which changed the synthetic multiplier k into the frame image instead of a long luminance signal is also considered with the signal composition means 7. Moreover, the configuration which asks for the synthetic multiplier k from the luminance signal extracted from the short signal which is a field image instead of the luminance signal extracted from the short signal changed into the frame image is also considered. In this case, since the short signal corresponding to even lines of a long signal does not exist, the way things stand, it cannot determine a synthetic multiplier, so that drawing 12 may show. In this case, what is necessary is just to ask for the synthetic multiplier of the location corresponding to even lines of a long signal from a surrounding short luminance signal or a surrounding synthetic multiplier.

[0129] Moreover, although the example of the approach of asking for the synthetic multiplier k from signal level in the gestalt 2 of operation of this invention was shown in drawing 18 , the decision approach of the synthetic multiplier k is not restricted to this, and the method of determining k nonlinear according to an intensity level, as shown in drawing 39 is also considered. Moreover, in the gestalt 3 of operation of this invention, although a short signal is used as 1 field image read in field read-out mode, it is not restricted to this, and the configuration which thins out and reads a level Rhine signal perpendicularly as an example as

raised to drawing 33 is also considered. In this case, what is necessary is just to consider it as a configuration as shown in drawing 40 , since a short signal is read without mixing the charge accumulated in the photo diode of two upper and lower sides on the solid state image sensor. With the configuration shown in drawing 40 , since 2 pixel mixing of vertical of a short signal is performed in 2 level Rhine addition means 27 (numbering is set to 27 in order to distinguish although it is 2 level Rhine addition means 701 and the same means), the same function as the configuration shown in drawing 20 as a result and effectiveness are realizable. However, it cannot be overemphasized that the contents of interpolation processing change according to how a short signal is thinned out in the luminance-signal interpolation means 12. For example, what is necessary is just to create the interpolation level Rhine signal of every two lines by interpolation between each level Rhine of a short luminance signal (drawing 41 (c)) so that it may be shown in the case of the signal thinned out as the short signal showed drawing 30 (for example, drawing 41). Moreover, it cannot be overemphasized that what is necessary is just to create a required level Rhine signal according to how a short signal is similarly thinned out in the interpolation means 702. In addition, in a configuration of thinning out and reading a level Rhine signal perpendicularly, the configuration which has two 2 level Rhine addition means of 2 level Rhine addition means 701 and 27 in drawing 40 is shown, but as raised to drawing 33 , it does not restrict to this, and a configuration without 2 level Rhine addition means 701 and 27 is also considered. In this case, the brightness extract from a long signal and a short signal is possible by making the luminance-signal extract means 70401 include a means to have the same effectiveness as 2 level Rhine addition means 701 and 27. Moreover, the configuration which does not have such 2 level Rhine addition means 701 and 27 has the effective color filter formed on the solid state image sensor 3 also in the image pick-up method which acquires a luminance signal and a chrominance signal, without consisting of primary color of (Red R) Green (G) and blue (B), and generally mixing the charge on the photo diode of a solid state image sensor 3. Moreover, in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, although two signals with which light exposure differs are made into the short signal which is 1 field image, and the long signal which is an one-frame image, they are not restricted to this, and they are good also as the long signal which is 1 field image depending on the application of a solid state camera, and a short signal which is an one-frame image. In this case, what is necessary is for the luminance-signal interpolation means 12 to perform vertical interpolation processing to the long luminance signal acquired from a long signal, and just to ask for the synthetic multiplier used in that case from the long luminance signal after interpolation processing that what is necessary is just to compound the long brightness and short luminance signal after interpolation processing in the luminance-signal composition means 13. Moreover, the configuration which asks for a synthetic multiplier from the luminance signal extracted from the long luminance signal before interpolation processing like the gestalt 1 of operation of this invention and the gestalt 2 of operation of this invention is also considered. Thus, a dynamic range expansion image with the high resolution in the high brightness section can be photoed by searching for a composite signal from the short signal which is the long signal and one-frame image which are 1 field image. Moreover, in the gestalt 3 of operation of this invention, the interpolation means 702 uses two one-line memory, although it is considered as the configuration which performs interpolation processing from the signal for 2 level Rhine, it does not restrict it to this, and the configuration which performs interpolation processing by high order interpolation processing from many level Rhine signals further, using much one-line memory further is also considered. Moreover, the configuration which performs the so-called last value interpolation which doubles the number of level Rhine with repeating 1 level Rhine inputted by a unit of 2 times, and outputting it is also considered.

[0130] Moreover, in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, although the luminance-signal interpolation means 12 makes a interpolation signal the addition average of 2 level Rhine signal, it is not restricted to this, and the configuration which performs interpolation processing by high order interpolation processing from many level Rhine signals further, and the configuration which acquires a interpolation

signal with last value interpolation are also considered.
[0131] In the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, the synthetic multiplier k for compounding a long luminance signal and a short luminance signal in the luminance-signal composition means 13 is not what is restricted to this although it shall ask for every pixel of a long luminance signal. Moreover, for example The configuration which calculates the synthetic multiplier k for every pixel from two or more averages, minimum values, maximums, or mean values of long luminance-signal level of a pixel, The configuration which makes two or more averages, minimum values, maximums, or mean values of a value of k the synthetic multiplier for every pixel among the values of k called for for every pixel is also considered.
[0132] Moreover, in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, the configuration which compounds in quest of a synthetic multiplier to the block which consists of two or more pixels is also considered with the luminance-signal composition means 13. For example, in drawing 43 , the long luminance signal YL11, and YL12, YL13 and YL14 are made into 1 block, respectively. If this, the short luminance signal YS11 which exists in homotopic, and YS12, YS13 and YS14 are made into 1 block, respectively It is also possible to compound by asking for a synthetic multiplier for every block of this 2-pixel unit. Composition of the block which becomes at this time YL11 and YL12, for example, long luminance signals, and the short luminance signals YS11 and YS12 will be performed like respectively (several 19), if the synthetic multiplier of this block is set to kb11. (YM is a luminance signal after composition) .
[0133]
[Equation 19]

$$YM11=(1-kb\ 11)\times YL11+kb\ 11\times YS11\times D$$
$$YM12=(1-kb\ 11)\times YL12+kb\ 11\times YS12\times D$$

[0134] In this case, what is necessary is just to let the synthetic multiplier kb 11 be the synthetic multiplier kb 11 of a block of k which can be found by the approach of one signal level of the long luminance signals (for example, Y11 and Y12 in drawing 43) corresponding to a block or the average of the long luminance signal corresponding to a block, maximum, the minimum value, and a mean value shown in drawing 18 from either at least. Moreover, the configuration made into the synthetic multiplier kb 11 of a block of the average value of the value (for example, k1, k2 in drawing 43) of k for every pixel called for by the approach shown in drawing 18 from each signal level of the long luminance signal corresponding to a block, maximum, the minimum value, or a mean value is also considered. In addition, it cannot be overemphasized that the number of pixels within a block is not necessarily 2 pixels.
[0135] Moreover, in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, with the luminance-signal composition means 13, the block which consists of two or more pixels is established, and the configuration used for synthetic processing of each pixel within a block of the synthetic multiplier which can be found by the approach shown in drawing 18 from the long luminance-signal level corresponding to the specific location within this block, for example, the center position of a block, is also considered. In this case, it is not necessary to ask for a synthetic multiplier for every pixel, and processing can be simplified. In addition, it is not necessary to restrict the location of the pixel used in case it asks for a synthetic multiplier to the center position of a block.
[0136] In the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention moreover, with the signal composition means 14 and 23 The synthetic multiplier k for compounding a long signal and a short signal is not what is restricted to this although the value calculated for every pixel by the synthetic multiplier generating means 1301 from the long luminance signal shall be used. For example, as shown in drawing 42 , the interior of the signal composition means 14 and 23 is uniquely equipped with the synthetic multiplier generating means 1404. The configuration which calculates the synthetic multiplier k for every pixel from two or more averages, minimum values, maximums, or mean values of long luminance-signal level of a pixel, The configuration which makes the average, the minimum

value, the maximum, or the mean value of k calculated from plurality among the values of k called for for every pixel the synthetic multiplier for every pixel is also considered. In addition, the function of the synthetic multiplier generating means 1404 is the same as that of the synthetic multiplier generating means 1301 here.
[0137] Moreover, in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, the configuration which compounds in quest of a synthetic multiplier to the block which consists of two or more pixels is also considered with the signal composition means 14 and 23. For example, in drawing 38 , the long signal (Ye+Mg) L11, and L (Cy+G)12, L (Ye+Mg)13 and L (Cy+G)14 are made into 1 block, respectively. If this, the short signal (Ye+Mg) S11 which exists in homotopic, and S (Cy+G)12, S (Ye+Mg)13 and S (Cy+G)14 are made into 1 block, respectively It is also possible to compound by asking for a synthetic multiplier for every block of this 2-pixel unit. If the synthetic multiplier of this block is set to kb11 (several 18) performs composition of the block which becomes at this time (Ye+Mg) L11 and L (Cy+G)12, for example, long signals, and the short signals (Ye+Mg) S11 and S (Cy+G)12 like. In this case, what is necessary is just to let the synthetic multiplier kb 11 be the synthetic multiplier kb 11 of a block of k which can be found by the approach of one signal level of the long luminance signals (for example, YL11 and YL12 in drawing 38) which exist in the same location as each block and a space target or the average of the long luminance signal which exists in the same location as a block and a space target, maximum, the minimum value, and a mean value shown in drawing 18 from either at least. Moreover, the configuration made into the synthetic multiplier kb 11 of a block of the average value of the value (for example, k1, k2 in drawing 38) of k for every pixel called for by the approach shown in drawing 18 from each signal level of the long luminance signal which exists in the same location as a block and a space target, maximum, the minimum value, or a mean value is also considered. In addition, it cannot be overemphasized that the number of pixels within a block is not necessarily 2 pixels.
[0138] Moreover, the block which consists of two or more pixels establishes, and the configuration which uses for synthetic processing of each pixel within a block of the synthetic multiplier which can be find by the approach showed in drawing 18 from the long luminance signal level which exists in the specific location within this block, for example, the center position of a block and the same location as a space target, is also consider with signal composition means 14 and 23 in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention. In this case, it is not necessary to ask for a synthetic multiplier for every pixel, and processing can be simplified. In addition, it is not necessary to restrict the location of the pixel used in case it asks for a synthetic multiplier to the center position of a block.
[0139] Moreover, in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, the configuration which makes a multiplier with the synthetic multiplier k fixed to the value acquired from the long luminance signal by the above-mentioned approach used with the signal composition means 14 and 23 the value which subtracted and added multiplication or a fixed multiplier is also considered.
[0140] Moreover, in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, the configuration for which it asks from the luminance signal (short luminance signal) extracted from the short signal which changed the synthetic multiplier k into the frame image instead of a long luminance signal is also considered with the luminance-signal composition means 13 and the signal composition means 14 and 23. Moreover, the configuration which asks for the synthetic multiplier k from the luminance signal extracted from the short signal which is a field image instead of the luminance signal extracted from the short signal changed into the frame image is also considered. In this case, since the short signal corresponding to even lines of a long signal does not exist, the way things stand, it cannot determine a synthetic multiplier, so that drawing 12 may show. In this case, the synthetic multiplier of the location corresponding to even lines of a long signal is calculated from the average, the maximum, the surrounding minimum value, or the surrounding mean value of a synthetic multiplier, using a surrounding short luminance signal or a surrounding

synthetic multiplier as it is, and can consider the **** approach etc. In addition, how to search for by interpolation processing from a surrounding synthetic multiplier and physical relationship is also considered.

[0141] Moreover, although the example of the approach of asking for the synthetic multiplier k from luminance-signal level in the gestalt 3 of operation of this invention and the gestalt 4 of operation of this invention was shown in drawing 18 , the decision approach of the synthetic multiplier k is not restricted to this, and the method of determining k nonlinear according to an intensity level, as shown in drawing 39 is also considered. Moreover, in the gestalt 4 of operation of this invention, although a short signal is used as 1 field image read in field read-out mode, it is not restricted to this, and the configuration which thins out and reads a level Rhine signal perpendicularly as an example as raised to drawing 33 is also considered. In this case, if 2 level Rhine addition means is made to perform 2 pixel mixing of vertical of a short signal like drawing 40 since a short signal is read without mixing the charge accumulated in the photo diode of two upper and lower sides on the solid state image sensor for example, it can realize the same function as the configuration shown in drawing 30 as a result, and effectiveness. However, it cannot be overemphasized that the contents of interpolation processing change according to how a short signal is thinned out in the luminance-signal interpolation means 12 like the gestalt 3 of operation of this invention. Moreover, it cannot be overemphasized that what is necessary is just to cull out according to how a short signal is similarly thinned out in the infanticide means 22 so that a long signal may become the same signal format as a short signal.

[0142] Moreover, although the configuration which performs infanticide processing of the perpendicular direction of a long signal with the infanticide means 22 in the gestalt 4 of operation of this invention explained, as shown in drawing 44 , a horizontal infanticide means 27 with the function which thins out a pixel horizontally from a picture signal establishes, and the configuration which thins out the horizontal pixel of both long signal which passed through 2 level Rhine addition means 701 by this, and short signal to one half is also considered. In this case, if a pixel horizontal as mentioned above is thinned out to one half, it is possible to transpose the one-line memory 15 and 16 for synchronization processing to the 0.5-line memory 28 and 29 of the capacity of that one half. Thus, it is possible to simplify further and to make cheap the configuration of the solid state camera of this invention by thinning out a pixel also horizontally. In that case, if the horizontal band limit of a long signal and a short signal is performed before performing horizontal infanticide processing, an unnecessary clinch will not occur by infanticide processing. If it band-limits perpendicularly similarly, even if it faces vertical infanticide processing, it cannot be overemphasized that an unnecessary clinch can be avoided.

[0143] Moreover, in the gestalt of operation of this invention of all above, the method of not restricting them to this, although [a long signal and a short signal] once memorized to an image memory 6, making the image memory 6 memorize either a long signal or a short signal, for example, synchronizing read-out from the solid state image sensor 3 of remaining one of the two's signal and signal read-out from an image memory 6, and processing composition is also considered. In this case, the capacity of an image memory 6 can be reduced and a solid state camera can be constituted still more cheaply.

[0144] Moreover, a Magenta as shows the color filter array formed on a solid state image sensor 3 to drawing 3 in the gestalt of operation of this invention of all above, It is not what is restricted to this although explained using the complementary color check type which consists of four colors of Green, yellow, and cyanogen. the Magenta (Mg) which gives an example if it becomes, as shown in drawing 45 , and Green -- the arrangement in which (G) does not carry out location reversal for every Rhine, and Green as shown in drawing 46 -- the configuration which arranges (G), cyanogen (Cy), and two complementary filters of yellow (Ye) in the shape of a stripe is also considered.

[0145] Moreover, a Magenta as shows the color filter array formed on a solid state image sensor 3 to drawing 3 in the gestalt of operation of this invention of all above, It is not what is restricted to this although explained using the configuration which consists of four colors of

Green, yellow, and cyanogen. If the configuration using the primary color filter which consists of Green (G), blue (B), and red (R) is also considered and an example is given as the filter arrangement The BEIYA method shown in drawing 47 , the INTARAIN method shown in drawing 48 , the G stripe RB perfect check method shown in drawing 49 , The stripe method shown in drawing 50 , the slanting stripe method shown in drawing 51 , the G stripe RB line sequential color TV system shown in drawing 52 , the G stripe RB dot sequential system shown in drawing 53 can be considered. Thus, when a primary color filter is used, it cannot be overemphasized that a luminance signal is searched for according to (several 20).
[0146]
[Equation 20]
輝度信号＝０．３×R＋０．５９×G＋０．１１×B

[0147] Moreover, a Magenta as shows the color filter array formed on a solid state image sensor 3 to drawing 3 in the gestalt of operation of this invention of all above, Since it considered as the complementary color check type which consists of four colors of Green, yellow, and cyanogen and read-out of a short signal was further explained as field read-out, in order to unite the signal format of a long signal and a short signal It is not what is restricted to this although the configuration including vertical 2 level Rhine addition processing of the long signal by 2 level Rhine addition means 701 was shown. When other filter arrangement as shown in above-mentioned drawing 45 - drawing 53 was adopted, or when performing not field read-out but infanticide read-out as shown in drawing 33 , it cannot be overemphasized that 2 level Rhine addition processing is not necessarily required.
[0148] moreover -- the above -- all -- this invention -- operation -- a gestalt -- setting -- composition -- a multiplier -- asking -- the time -- a threshold -- Th#max -- Th#min -- Th#max -- ' -- Th#min -- ' -- respectively (several 21) -- like -- setting up -- long duration -- exposure -- a signal -- a short time -- exposure -- a signal -- weighting -- addition -- not but -- being certain -- signal level -- a boundary -- changing -- a configuration -- thinking -- having .
[0149]
[Equation 21]
Th_max＝Th_min
Th_max' ＝Th_min'

[0150]
[Effect of the Invention] As mentioned above, according to this invention, by controlling exposure of a solid state image sensor, and signal read-out mode, photoing the short-time exposure signal for the 1 field, and the prolonged exposure signal for one frame, and compounding these, though it has the resolution of the number average of pixels of a solid state image sensor, the image to which the dynamic range was expanded can be photoed. Since IT-CCD generally used for the solid state image sensor furthermore used with this solid state camera with the noncommercial solid state camera is usable, it is not necessary to use two or more solid state image sensors and special solid state image sensors, and equipment can be constituted cheaply.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the solid state camera by the gestalt 1 of operation of this invention
[Drawing 2] The explanatory view in the signal read-out mode from the solid state image sensor 3 in the gestalt 1 of operation of this invention
[Drawing 3] Drawing showing the example of the color filter arrangement formed on the solid state image sensor 3 in the gestalt 1 of operation of this invention
[Drawing 4] The block diagram showing the configuration of the signal composition means 7 in the gestalt 1 of operation of this invention
[Drawing 5] The block diagram showing the configuration of 2 level Rhine addition means 701 in the gestalt 1 of operation of this invention
[Drawing 6] The block diagram showing the configuration of the interpolation means 702 in the gestalt 1 of operation of this invention
[Drawing 7] The block diagram showing the configuration of the weighting addition means 703 in the gestalt 1 of operation of this invention
[Drawing 8] The explanatory view explaining the principle of the dynamic range expansion in the gestalt 1 of operation of this invention
[Drawing 9] The explanatory view for explaining exposure and read-out timing of the long signal in the gestalt 1 of operation of this invention, and a short signal
[Drawing 10] The explanatory view for explaining the short signal in the gestalt 1 of operation of this invention
[Drawing 11] The explanatory view for explaining the long signal in the gestalt 1 of operation of this invention
[Drawing 12] The explanatory view for explaining 2 level Rhine addition processing and interpolation processing in a gestalt 1 of operation of this invention
[Drawing 13] The graph for explaining the synthetic multiplier decision approach in the gestalt 1 of operation of this invention
[Drawing 14] The explanatory view for explaining the approach of the signal composition processing in the gestalt 1 of operation of this invention
[Drawing 15] The block diagram showing the configuration of the weighting addition means 704 in the gestalt 2 of operation of this invention
[Drawing 16] The block diagram showing the configuration of the luminance-signal extract means 70401 in the gestalt 2 of operation of this invention
[Drawing 17] The explanatory view for explaining the creation approach of the long luminance signal in the gestalt 2 of operation of this invention
[Drawing 18] The graph for explaining the synthetic multiplier decision approach in the gestalt 2 of operation of this invention
[Drawing 19] The explanatory view for explaining the approach of the signal composition processing in the gestalt 2 of operation of this invention
[Drawing 20] The block diagram showing c solid state camera
[Drawing 21] The block diagram showing the configuration of the luminance-signal interpolation means 12 in the gestalt 3 of operation of this invention
[Drawing 22] The block diagram showing the configuration of the luminance-signal composition

means 13 in the gestalt 3 of operation of this invention
[Drawing 23] The block diagram showing the configuration of the signal composition means 14 in the gestalt 3 of operation of this invention
[Drawing 24] The block diagram showing the configuration of the synchronization means 19 in the gestalt 3 of operation of this invention
[Drawing 25] The explanatory view for explaining the long luminance signal in the gestalt 3 of operation of this invention
[Drawing 26] The explanatory view for explaining the short luminance signal in the gestalt 3 of operation of this invention
[Drawing 27] The explanatory view for explaining interpolation processing of the luminance signal in the gestalt 3 of operation of this invention
[Drawing 28] The explanatory view for explaining the synthetic approach of the luminance signal in the gestalt 3 of operation of this invention
[Drawing 29] The explanatory view for explaining the synchronization processing by the synchronization means 19 in the gestalt 3 of operation of this invention
[Drawing 30] The block diagram showing the solid state camera in the gestalt 4 of operation of this invention
[Drawing 31] The block diagram showing the configuration of the synchronization means 24 in the gestalt 4 of operation of this invention
[Drawing 32] The explanatory view for explaining the synchronization processing by the synchronization means 24 in the gestalt 3 of operation of this invention
[Drawing 33] The explanatory view showing another example of the picture signal read-out approach from a solid state image sensor 3
[Drawing 34] The explanatory view for explaining 2 level Rhine addition processing and interpolation processing at the time of making a long signal into field drawing and making a short signal into frame drawing in the gestalt 1 of operation of this invention
[Drawing 35] The explanatory view for explaining last value interpolation processing
[Drawing 36] The explanatory view showing another example of the synthetic approach of the long signal in the gestalt 1 of operation of this invention, and a short signal
[Drawing 37] The graph which shows another example of the approach of determining a synthetic multiplier from the long signal level in the gestalt 1 of operation of this invention
[Drawing 38] The explanatory view showing another example of the synthetic approach of the long signal in the gestalt 2 of operation of this invention, and a short signal
[Drawing 39] The graph which shows another example of the approach of determining a synthetic multiplier from the long luminance-signal level in the gestalt 2 of operation of this invention
[Drawing 40] The block diagram of the solid state camera at the time of changing an approach reading a short signal in the gestalt 3 of operation of this invention
[Drawing 41] The explanatory view for explaining the contents of the luminance-signal interpolation processing at the time of changing an approach reading a short signal in the gestalt 3 of operation of this invention
[Drawing 42] The block diagram showing another configuration of the signal composition means 14 in the gestalt 3 of operation of this invention
[Drawing 43] The explanatory view showing another example of the synthetic approach of the long luminance signal in the gestalt 3 of operation of this invention, and the gestalt 4 of operation of this invention, and a short luminance signal
[Drawing 44] The block diagram showing another example of the solid state camera in the gestalt 4 of operation of this invention
[Drawing 45] Drawing showing another example of the color filter arrangement formed on a solid state image sensor 3
[Drawing 46] Drawing showing another example of the color filter arrangement (CyYeG stripe method) formed on a solid state image sensor 3
[Drawing 47] Drawing showing another example of the color filter arrangement (BEIYA method) formed on a solid state image sensor 3

[Drawing 48] Drawing showing another example of the color filter arrangement (INTARAIN method) formed on a solid state image sensor 3
[Drawing 49] Drawing showing another example of the color filter arrangement (G stripe RB perfect check method) formed on a solid state image sensor 3
[Drawing 50] Drawing showing another example of the color filter arrangement (stripe method) formed on a solid state image sensor 3
[Drawing 51] Drawing showing another example of the color filter arrangement (slanting stripe method) formed on a solid state image sensor 3
[Drawing 52] Drawing showing another example of the color filter arrangement (G stripe RB line sequential color TV system) formed on a solid state image sensor 3
[Drawing 53] Drawing showing another example of the color filter arrangement (G stripe RB dot sequential system) formed on a solid state image sensor 3
[Description of Notations]
1 Optical Lens
2 Machine Shutter
3 Solid State Image Sensor
4 Analog Signal Processing Means
5 A/D-Conversion Means
6 Image Memory
7 Signal Composition Means
8 Digital-Signal-Processing Means
9 Shutter Drive Control Means
10 Solid State Image Sensor Drive Control Means
11 System Control Means

[Translation done.]